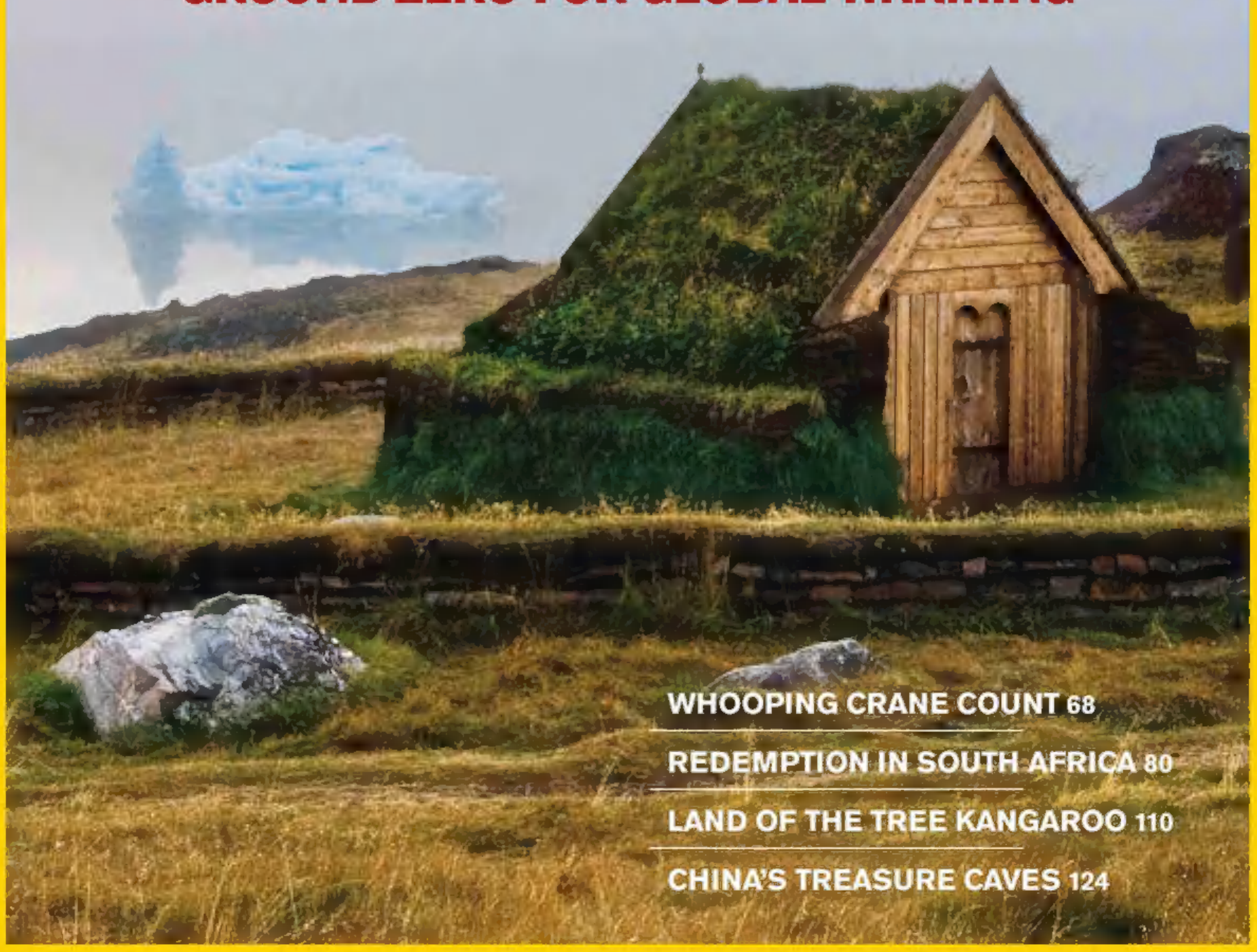
NGM.COM | JUNE 2010

NATIONAL GEOGRAPHIC

Greenland

GROUND ZERO FOR GLOBAL WARMING



2010 Toyota RAV4 4x2

MPG: 28 – EPA est hwy

Hwy Driving Range: 445 miles

Five-Star Crash Safety Rating: no*

Powertrain Warranty: 5 years/60,000 miles**

A Consumers Digest Best Buy: no

Automatic Crash Response: not available

Link to Emergency Services: not available

*Government star ratings are part of the National Highway Traffic Safety Administration's (NHTSA's) New Car Assessment Program (www.safercar.gov).
**Whichever comes first. See dealer for limited warranty details.
†Visit onstar.com for details and system limitations.

2010 Chevy Equinox FWD

MPG: 32 – EPA est hwy

Hwy Driving Range: 600 miles

Five-Star Crash Safety Rating: yes*

Powertrain Warranty: 5 years/100,000 miles**

A Consumers Digest Best Buy: yes

Automatic Crash Response: OnStar®/1 year standard†

Link to Emergency Services: OnStar/1 year standard

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Western Hermann's Tortoise *(Testudo hermanni hermanni)*
Size: Head and body length, 11.9 - 18.3 cm (4.7 - 7.2 inches) **Weight:** 365 - 1,350 g (12.9 - 47.6 oz)
Habitat: Densely wooded hillsides and gentle slopes with coarse vegetation in coastal areas of southern France, Italy and Spain **Surviving number:** Unknown; populations declining

Photographed by Ingo Arndt

WILDLIFE AS CANON SEES IT

Hot or not? It's a question of considerable importance to the western Hermann's tortoise, as heat plays a key role in its life. For eight to ten days after emerging from hibernation, the tortoise ventures out during the warmest parts of the day to bask; this speeds its metabolism and inspires it to greater activity. Heat also determines the number of males or females that hatch, with hotter nest temperatures resulting in more females. When the mercury rises too high, however, it can kill the mother as she lays eggs. With human encroachment threatening to upset the delicate balance in which it lives, the tortoise is now really feeling the heat.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit **canon.com/environment** to learn more.

Canon

NATIONAL GEOGRAPHIC

JUNE 2010 · VOL. 217 · NO. 6

JAMES BALOG

A melting glacier can form a lake, which then might carve a deep shaft. Above, an ice explorer drops in for a closer look. Story on page 34.

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY

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My Project getting ten thousand children in Harlem on the path to college

Why I got started I grew up just like my kids and know firsthand how unfair life can be

My first step Turning around one block in Harlem

What we do for others we level the playing field

What they do for us They inspire us with their courage and determination

Proudest moment Breakfast with my straight-A students

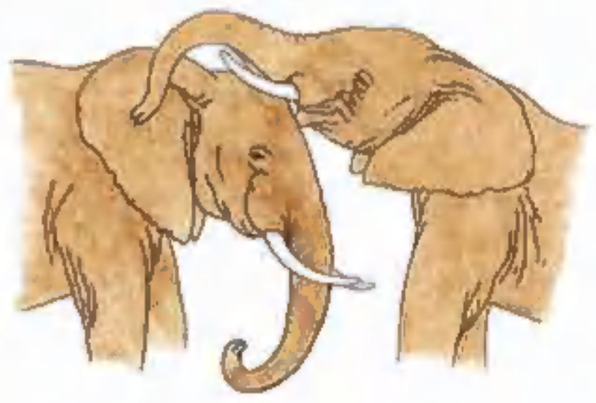
My next step Replicating the idea in other cities

American Express Has been a key partner in our making a difference

TAKE CHARGE:

NATIONAL GEOGRAPHIC

DEPARTMENTS



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Vanishing Ice

An animated graphic shows just how Greenland's ice sheet is melting. And there's a lot to show: Greenland is warming up nearly twice as fast as the rest of the planet.

On the Cover

The Greenland church is a replica of the one Erik the Red built for his wife around A.D. 1000—when the island clime was relatively mild.
Photo by Peter Essick

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PASSION for EXCELLENCE

EDITOR'S NOTE

Fans of Soweto's Kaizer Chiefs soccer club cheer during the team's December 2009 match against Ajax Cape Town.

We felt the celebration move like a windstorm across Johannesburg on June 24, 1995. People danced in the streets, hugging strangers. The South African Springboks had defeated the New Zealand All Blacks in overtime at Ellis Park Stadium, winning the Rugby World Cup. As I sat in a living room seven miles from the stadium with friends and watched on television, South Africa's newly elected president, Nelson Mandela, walked onto the field in a Springbok jersey to present the trophy. Rugby and the Springboks had been, in apartheid South Africa, symbols of white privilege and power. When Mandela, who'd been imprisoned for 27 years by that racist regime, presented the trophy to the white captain of the Springboks and congratulated players of the nearly all-white team, he did more than just celebrate a rugby victory. He honored a nation that was coming together and moving forward.

In 2004 South Africans celebrated again when they were chosen to host soccer's 2010 World Cup games. This month the world will watch that tournament play out on the fields of their country. It too will be more than a sporting event. Apartheid is gone, but the slow process of reconciliation continues. In this issue, photographer James Nachtwey shows us contemporary South Africa, while writer Alexandra Fuller tells about a town, a victim of a hate crime, and the prisoner responsible. It's a tale of forgiveness and redemption—a story, one South African minister says, about how a nation prepares for the future.

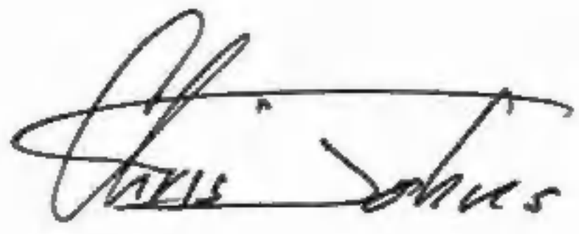

PHOTO: JAMES NACHTWEY

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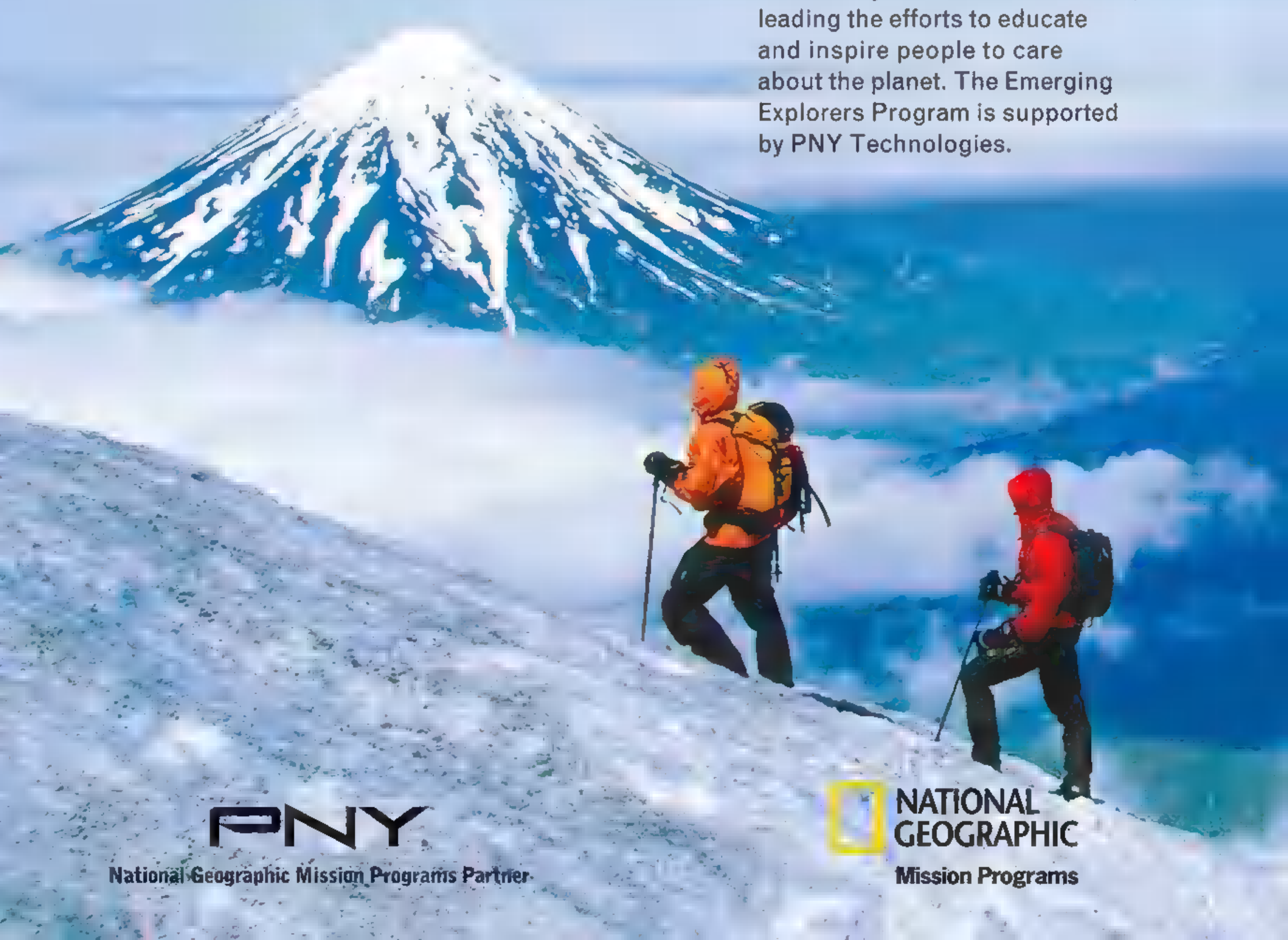
Visit *nationalgeographic.com/emerging* to see and hear the Emerging Explorers.



PNY

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NATIONAL GEOGRAPHIC

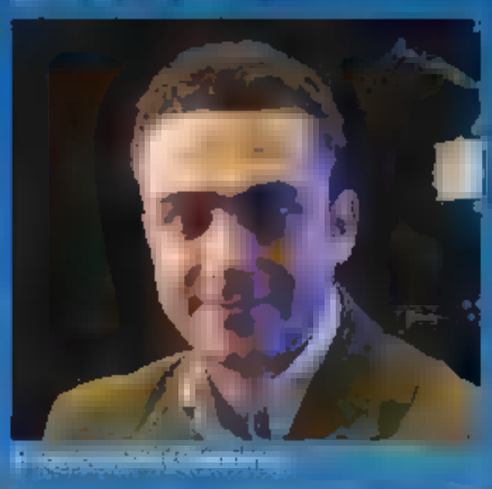
Mission Programs

Environmental Scientist Saleem Ali resolves environmental conflicts through mediation and education that unites governments, companies, and communities around shared natural resources.

Educator and Activist Kakenya Ntaiya fights child marriage and educational barriers to girls with her unique primary school for girls in rural Kenya.

Mobile Technology Innovator Ken Banks created a free software program that revolutionizes the effectiveness of grassroots nonprofit groups through the power of mobile technology and text messaging.

Photo: Karola Riegle



Electrical Engineer Aydogan Ozcan modifies ordinary cell phones into medical imaging tools, bringing lifesaving diagnoses to the world's most resource-poor regions.

Wildlife Biologist Aparajita Datta saves [illegible]

Musician and Activist Feliciano dos Santos battles disease in Mozambique, using the music of his internationally acclaimed band to spread health and [illegible]

Agroecologist Jerry Glover [illegible]

Molecular Biologist Beth Shapiro [illegible]

Bioarchaeologist Christine Lee analyzes ancient skeletal remains, bringing new understanding of China and Mongolia's rich cultural diversity, past and present.

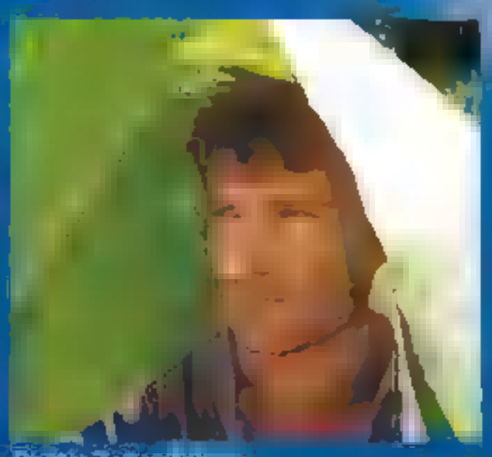
Photo: Rick Zhang

Photo: John Goodrich/WCS

Wildlife Researcher and Conservationist Emma Stokes [illegible] conservation techniques to efforts that protect endangered tigers in Asia and have helped her discover the world's largest gorilla population in Congo.

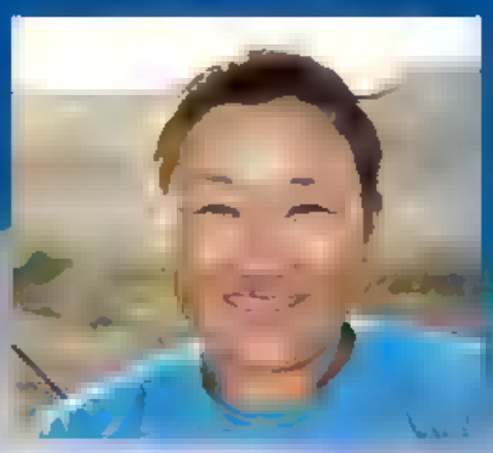
Research Scientist and Engineer Albert Yu-Min Lin pioneers a new era of exploration, combining noninvasive computer technologies and a passion for adventure to make discoveries without breaking ground.

Photo: Erik Jepsen/Calit2



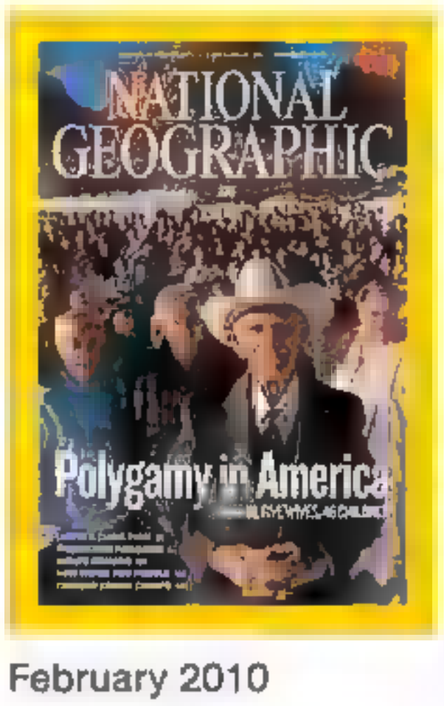
Herpetologist Gabriela Takacs [illegible] for venomous snakes, then develops technologies that could turn venom into breakthrough drug leads with unprecedented speed and precision.

Paleontologist Bolortsetseg Minjin unearths extraordinary [illegible] and mammal [illegible]



Marine Biologist and Conservationist José Urteaga revolutionizes sea turtle conservation in Nicaragua, blending concern and creativity to change attitudes away from [illegible] and toward [illegible]

LETTERS



February 2010

The Polygamists

To infer that Fundamentalist Church of Jesus Christ of Latter-Day Saints communities are some sort of quaint slice of Americana whose residents have built ■ "self-sustaining" environment misses the main reason the inhabitants can afford their late-model SUVs and cell phones. If an FLDS man has four wives, only one of them is legally married in the eyes of the state and federal government. The other three are single women with no income, no assets, and multiple children who apply for and consume every state and federal entitlement benefit for which they are eligible. These communities thrive through the generosity of the American taxpayer and the willingness of state authorities to turn a blind eye to the misuse of entitlement funds.

TIM CROMWELL
Salt Lake City, Utah

I'd like to see if the smiles on the faces of these crusty old husbands would remain if they were forced to live in a community where each wife would have many husbands and the men would be relegated to doing the sewing and cleaning, while the wives were tending to the divine purpose of producing offspring by mating with their younger husbands.

NEAL GRACE
San Rafael, California

Are you kidding me? To approach the FLDS "breeding farm" and this crime against women with an attitude even approaching equanimity is irresponsible. These children are never given a choice. The practice of passing wives on as property is beyond comprehension.

SANDRA MILLER
Phoenix, Arizona

The article on the FLDS is truly remarkable. The research into the group's history and dynamics is impressive in view of the fact that access to FLDS members has been limited by its leaders for decades. The FLDS, and essentially all "Mormon fundamentalists," selectively emphasize a few fundamentals of the mother church, ignoring other principles that do not fit with their goals. For example, the FLDS community ignores missionary work, which could be considered the most fundamental of all Joseph Smith's teachings. I'm encouraged by the new openness of the FLDS and hope it will allow them to study their own history and traditions.

BRIAN C. HALES
Layton, Utah

I'm a business owner, mom of four, and a triathlete. I'm also Mormon, and, oh yeah, my husband has just one wife. From the references in Scott Anderson's article, some readers might wonder how I fit my big hair under my biking helmet. I was annoyed by the too frequent flip-flop between calling the polygamist group by their accurate title of FLDS and the inaccurate term of Mormon. The FLDS are not Mormon. I feel no kinship with the women of the FLDS group. Rather, I feel pity for the girls and disgust for the men. I do not appreciate my religion being associated by confusing textual references to these sad, oppressed people.

ERIKA WILDE
Springville, Utah

One lesson here is to be leery of any religion where men dictate that women dress differently from the mainstream while allowing men to blend in.

LINDA DIXON
New Castle, Colorado

These people are being treated as criminals, when they are victims. The photo caption on page 44 states that more than 400 women, girls, boys, and babies were "taken into protective custody." That's like saying Japanese Americans were taken into protective custody during World War II.

D. B. MITCHELL
Kingman, Arizona

Referring to FLDS members as "breakaway Mormons" is equivalent to labeling Lutherans as breakaway Catholics.

FLINT STEPHENS
Highland, Utah

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LETTERS

The article confirms my conviction that where "religious reasons" are trotted out as a rationale for doing—or not doing—something, then there is no good reason. If there were, it would be used instead.

DEREK MURPHY
Bad Pyrmont, Germany

Great article on polygamy. I'm from that background, and they are my relatives. I've read a lot of stories on the subject, but yours is the only one to tag the matriarchal nature of the society. Early Mormon leaders knew what they were doing when they chose the beehive as the symbol of the state of Utah. Check with a beekeeper to see what the sexual power structure is in a hive.

DUANE CARLING
Farmington, Utah

Hubble Renewed

How can anyone look at page 124 and wonder if we are really alone? You have to be very naive to think that we are. That one section of the universe must contain hundreds of thousands of stars with solar systems. How many of those systems have life? Would they look like us? Are they more advanced or still in the Stone Age? They can only do what we do, look up and wonder.

JOHN J. GARZI
Staten Island, New York

The Truth About Chimps

As I read the article, which details humans observing chimps observing humans, I wondered if the chimps were savvy enough to take in the human cultural phenomena that led a male scientist (Dave Morgan) to visit their Congolese homeland, followed by a female scientist (Crickette Sanz). The story notes that Sanz's presence and her partnering with Morgan several years after he arrived allowed him to persevere in a remote area with spartan accommodations and minimal logistical support. Do chimps know what love is?

BOB GARNETT
Charlottesville, Virginia

Early Mormon leaders knew what they were doing when they chose the beehive as the symbol of the state of Utah. Check with a beekeeper to see what the sexual power structure is in a hive.

Protecting Patagonia

My wife, Katherine, and I were in the U.S. Peace Corps from 1976 to 1979 in Torres del Paine National Park in the Patagonian region of Chile. With park rangers José Alarcón and Oscar Guineo, we pioneered the trekking trail that the 100,000 visitors now follow. The ecotourism provided by this incredible national park is a great economic opportunity for a region that has been severely overgrazed and is in need of recuperation.

BRIAN L. HOUSEAL
Elizabethtown, New York

As ■ Chilean, I enjoyed your article about protecting Patagonia. However, a key element to understanding threats to the region was missing: the economy. The growth of the salmon industry is demand driven. Chile exports a large percentage of its production to the United States and Japan. Both countries have free trade agreements with Chile, so farmed salmon enters the U.S. and Japan almost tariff free. If your readers wish to contribute to protecting the Chilean fjords, they should look at their diets.

ENRIQUE YURI
Alexandria, Virginia

The Big Idea: Terraforming Mars

Apparently we are to support NASA's pipe dream of landing and settling on Mars as a means to relieve some of the stress on Earth and revive the manned space program. Manned space flight has brought few if any solutions to Earth's problems, considering the billions spent on it. A resolution of overpopulation would discount any need for space travel. Exploding population on this planet far overshadows any other problem we face.

DAVE HOLAWAY
Eagar, Arizona

The answer to your question, "Could we 'terraform' Mars?" may be, "No, we probably could not." The resources required would likely be more effectively and usefully spent in an effort to prevent de-terraforming Earth by rapidly adding too many greenhouse gases to the atmosphere.

CONWAY LEOVY
Professor Emeritus
Atmospheric Sciences and Geophysics
University of Washington
Seattle, Washington

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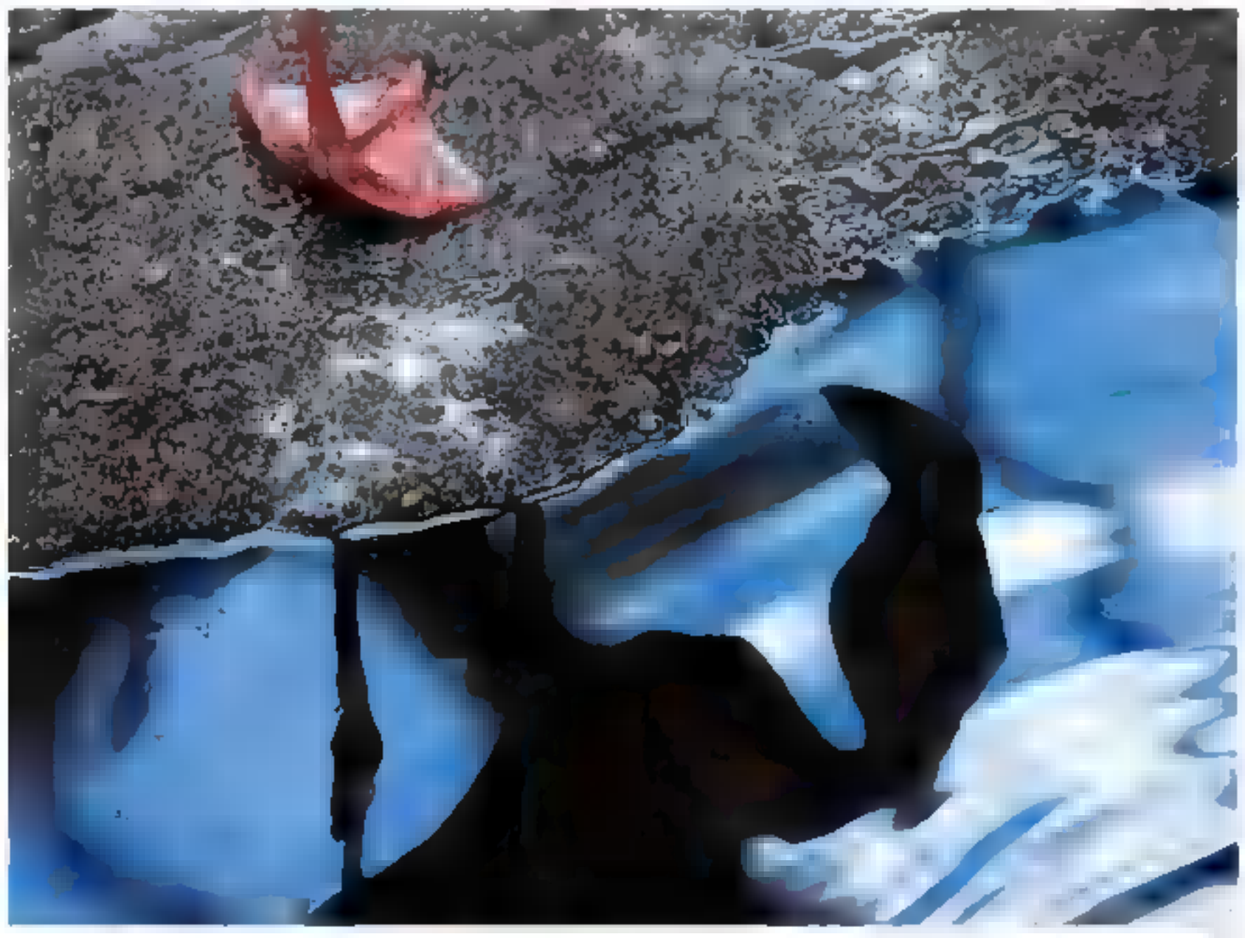
Finding the Mood Whether it's an epic battle (fought by ants) or a flamingo's quiet moment of reflection, we love to see what you're shooting—and want to see more. Keep sending your pictures to Your Shot. Every month this page features two photographs: one chosen by our editors, one chosen by our readers via online voting. For more information, go to *ngm.com/yourshot*.

EDITORS' CHOICE

Luke Chua Hwa Yong Singapore

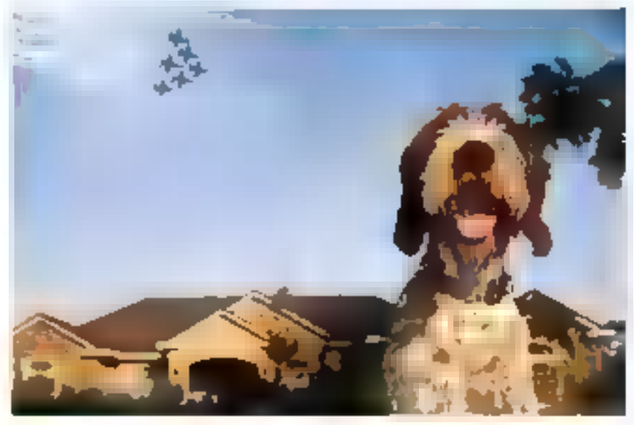
"I saw a group of red ants attacking a poor black ant," says Luke Chua, 39, ■ workshop supervisor who shot this in a local park. "I think we know what's going to happen next."



READERS' CHOICE

Andrew Kenutis Eden Prairie, Minnesota

At the Minnesota Zoo "the environment lends itself to great lighting and reflections in the water," says Kenutis, 25. Here a flamingo steps clear of water that captures its silhouette.



GETTING REAL

We get a lot of letters at *National Geographic*. We received several from readers insisting that William Lascelles's photograph on the February 2010 Your Shot page was ■ fake. Our readers were right.

The Your Shot rules specify, "Please provide only the original, unmodified camera image." Lascelles submitted a picture of a dog against a background of jets in the sky (above). After he learned that it had been chosen for the magazine, Lascelles told our writer the frame was ■ "once in a lifetime" shot. He confirmed that statement for our researcher. When Senior Photo Editor Susan Welchman asked him, prior to publication, to verify the image with the next photo in his shooting sequence, Lascelles sent her another picture of the dog—head turned this time—with the same jets above.

It turned out to be a fake too.

Lascelles has now admitted that he fabricated both images he sent us. We apologize for publishing his work. And we thank you for speaking up.

Now we're looking more closely at all Your Shot pictures. We recently discovered that Ivan Dobrev's December 2009 Your Shot photo of a window of bright blue sky in a dim warehouse was faked as well. We're sorry for publishing that one too.

"Your Shot shooters hunt down images that mean something to them," says Welchman, who looks at some 300 Your Shot photographs every day. "That's what Your Shot is supposed to be. It's real moments of real people in real life."

So go on out and capture what you see. It'll be better than anything you can make up and paste together on a computer screen. We hope you'll keep sending us your shots. We want to see what is real.

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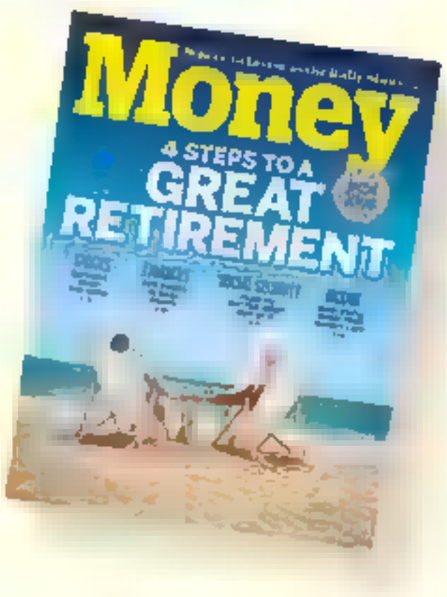
years, folks are they were just a few years ago. Sure, But there's also a lot of 

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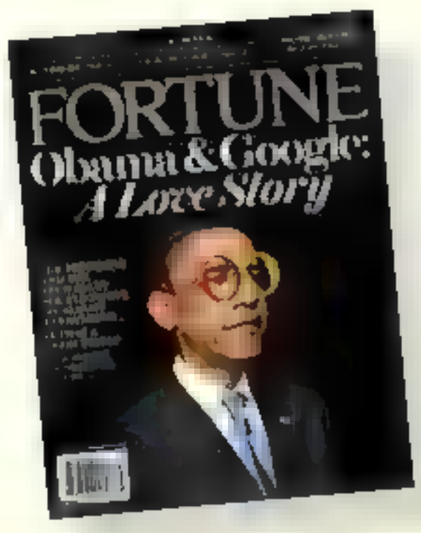
there's a 

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United States Like ■ glass sculpture forged in the Pacific's eternal churn, ■ four-foot-tall backwash splash—the result of two waves colliding in the shallows near Kaena Point on Oahu, Hawaii—refracts the saturated glow of dawn.

PHOTO: CLARK LITTLE

Sweden Near the village of Enviken, where nostalgia for mid-century Americana runs deep, 17-year-old Fanny Bergman (at left) and mother Ulrika Dotzsky, 48, head to a rockabilly concert in their 1959 Mercury Montclair.

PHOTO: ÅSA SJÖSTRÖM, MOMENT/SYDSVENSKAN

United States Over the past 17 years a decidedly sticky situation has developed in Seattle's Post Alley, where countless colorful wads—pressed down with coins or used to spell out names and places—form the "gum wall."

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PHOTO: JORDAN SIEMENS, AURORA PHOTOS

my Father, the Captain

A first look at Jean-Michel Cousteau's new memoir about his life with the legendary Jacques Cousteau.

Excerpted from Chapter Six:

Waiting for Calypso

In the first version of the story, the magical version that suggests that the *Calypso* appeared before him like something out of a storybook, Dad was out for a stroll in the harbor village of La Valette-du-Var, on the island of Malta. La Valette is a charming village that even today feels old and new all at once, rich with history and at the same time utterly contemporary and altogether vibrant, although in 1950, the large naval ships in the port were a bleak reminder that the island was still under British rule.

In this very harbor, my father took to saying that the *Calypso* fore him for the first time. He fell immediately under her spell. He described the ship to his collaborator Yves Paccalet in the following terms: "With her half-white, half-black wooden planking, anchored among the fishing boats and battleships, she enchanted me immediately. I want her. I shall have her. I read her name on the hull: *Calypso C.* At that moment, I realized that I will command her and that I will sail her to the end of the world...."

It is a romantic vision, yes? And yet there is another account that seems far more reliable. I heard my father tell this complementary version many times as well and came to suspect that the truth rested in the balance of these two stories. In the second version, my father was visiting Auron, a ski resort in the south of France, and he was at dinner with friends, talking about his dream of exploring the world's oceans. He expressed his frustration with *L'Elie Monnier* and told of the difficulties he was having requisitioning a more suitable vessel from the French Navy. JYC was a wonderful dreamer, a wonderful storyteller, a wonderful dinner companion—and from the accounts of those present, he was his usual effervescent self on this night. When my father stood to leave, he was approached by a gentleman who had been seated at the next table. The man appeared to have been caught in the swirl of my father's enthusiasm. He said,

Continued on Kindle

JEAN-MICHEL COUSTEAU is the founder and president of the Ocean Futures Society *(oceanfutures.org)*. He is the recipient of many awards, including Emmys, a Peabody, a 7d'Or, and the Cable ACE Award, and has produced more than 80 films. Cousteau is the executive producer of the PBS television series *Jean-Michel Cousteau: Ocean Adventures*. Jacques Cousteau would have celebrated his 100th birthday in June 2010.

NATIONAL GEOGRAPHIC
BOOKS

Golden Touch The World Cup title might be the most coveted honor in soccer, but there's one thing the winning nation can't possess: the actual trophy. The 18-karat-gold statue (right) has been kept mostly under lock and key at an undisclosed location since its predecessor, the Jules Rimet trophy, was stashed under ■ bed during World War II, held for ransom and recovered, then stolen for good in Brazil in 1983. That statue was first pinched in March 1966 from an exhibition in London, which hosted the final match that year. Fortunately ■ dog named Pickles helped his nation save face by ferreting out the newspaper-wrapped trophy in a garden, earning him ■ place alongside the prime minister when England celebrated its World Cup win that summer. It hasn't won since.

The champions of this summer's tournament in South Africa will get to keep only a gold-plated replica of the post-Rimet prize. But legions of soccer fans had ■ rare chance to see the real thing up close: The current trophy, in use since 1974, was the focus of a recent 83-country grand tour. "Only heads of state and World Cup winners can hold the trophy," says FIFA spokesman Alex Stone. The rest of us can only look—and dream. *—Luna Shyr*

The current World Cup trophy depicts two victorious athletes holding up ■ globe.

Soccer star Garrincha (second from left) and well-wishers celebrate Brazil's 1962 victory with the Jules Rimet trophy.

PHOTOS: FRITZ REISS, AP IMAGES (TOP); POPPERFOTO/GETTY IMAGES

NG GRANTEE

Male Bonding

In the matriarchal world of elephants, males are known as mostly independent sorts. Females maintain close, lifelong family ties, while bulls tend to wander off solo, at times banding with another male or more loosely with groups of them.

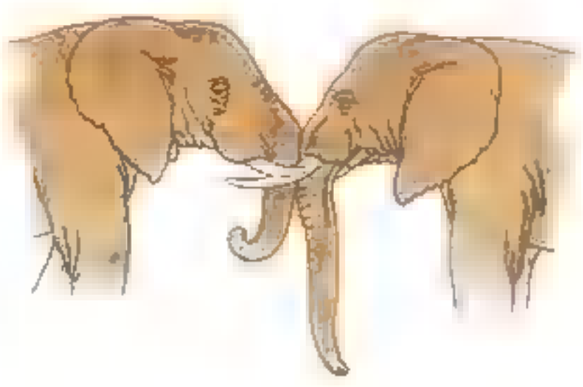
Or do they? During a six-year study in Namibia's Etosha National Park, Stanford University behavioral ecologist Caitlin O'Connell-Rodwell observed for the first time intense, long-lasting bonds among a dozen or so bulls—a tight-knit group of teenagers, adults, and seniors up to 55 she's dubbed the Boys' Club. Older males serve as mentors and mediators for younger ones, enforcing a strict social hierarchy and keeping underlings in line when hormones rage and rowdiness may erupt.

In drought-prone Namibia, rank becomes most rigid when water is scarcest. "In dry years the strict pecking order they establish benefits all of them," O'Connell-Rodwell says. "Everyone knows their place." That means young bulls supplicate more frequently to their elders—and peace is maintained while everyone gets to drink. *—Hannah Bloch*

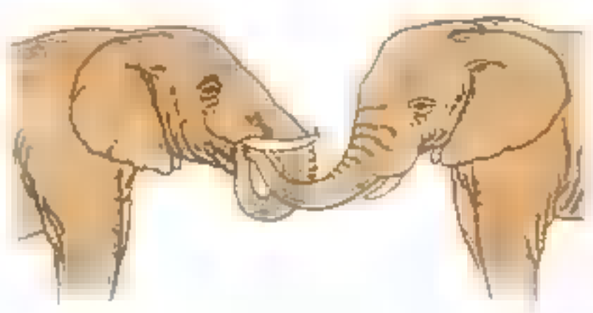
Two males' entwined trunks signal friendship and trust.

TRUNK TALK
Close-up communication is done vocally and via smell and touch. These gestures show affection.

Like arm-wrestling kids, elephants will test their strength against peers—and sometimes trusted elders.



A junior elephant (right) greets a senior with deference, placing its trunk tip into the elder's mouth.



An over-the-head caress by a dominant elephant is akin to human hair tousling, says O'Connell-Rodwell.

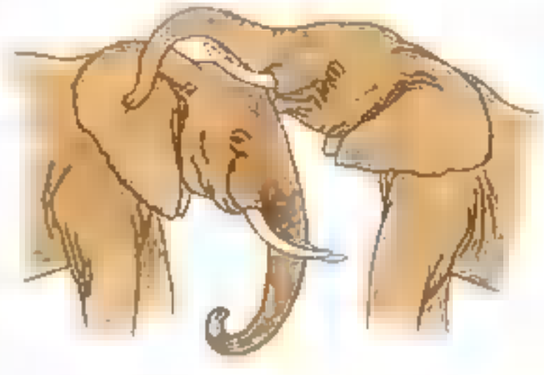
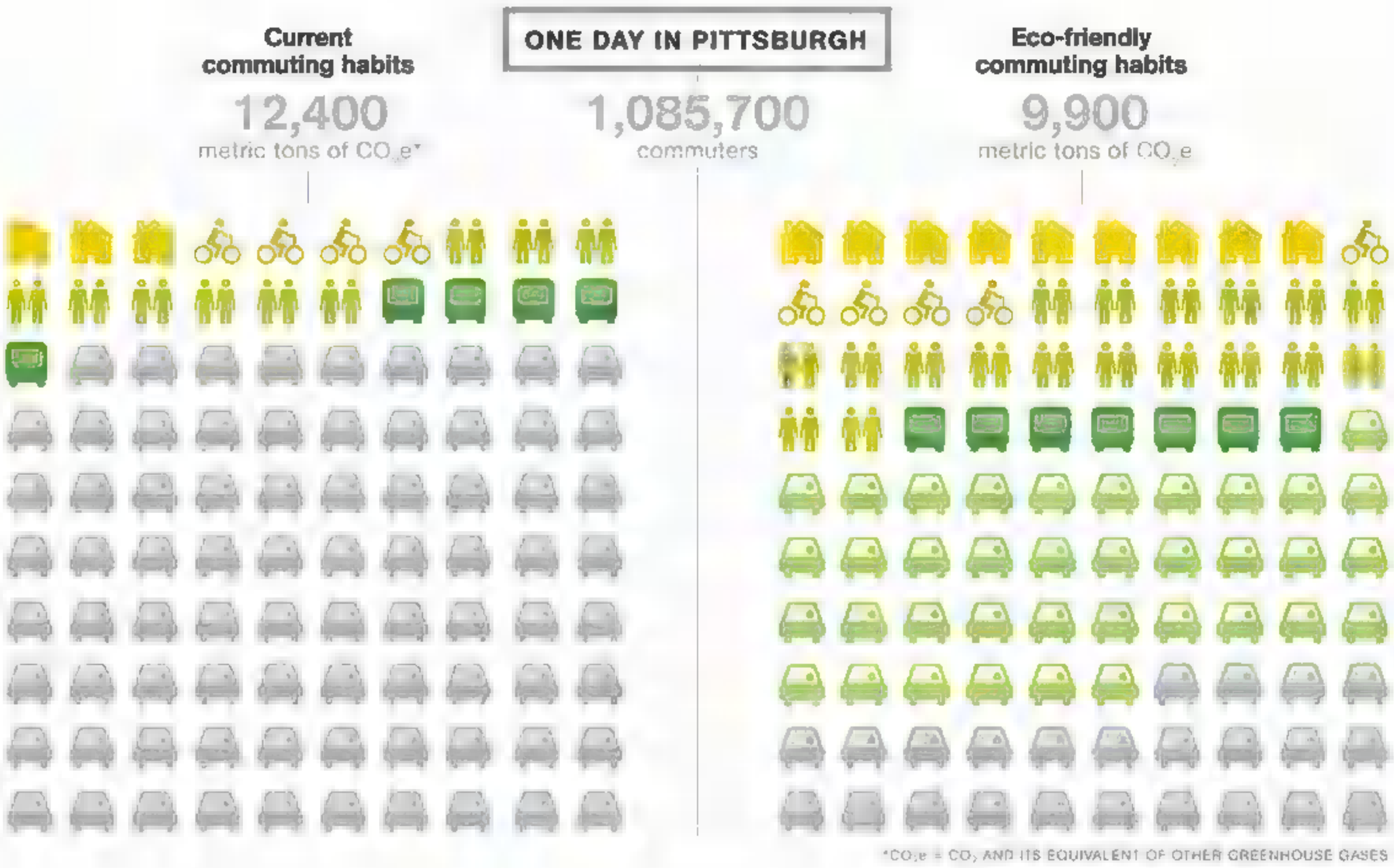


PHOTO: O'CONNELL & RODWELL
ART: ALDO CHIAPPE

A Day With Less Driving

Can one day of eco-commuting make a difference? Pittsburgh is the case study. Compare the typical workday breakdown for the city and its metropolitan area (left) with a hypothetical green day (right).



What if commuters were to cut back on driving for just one day? That's not the kind of sweeping change environmental advocates urge. But it seems doable. And there is an ongoing effort to encourage one-day vacations from Earth-unfriendly activities. The big question: Would a day of less driving make any significant difference?

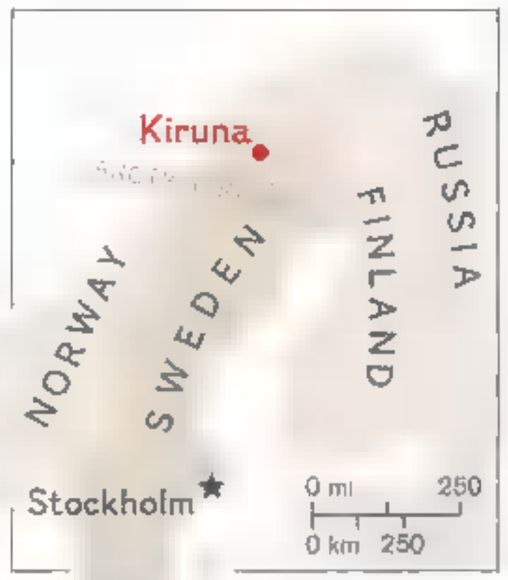
To find out, *National Geographic* asked Luke Tonachel, vehicles analyst for the Natural Resources Defense Council, to crunch numbers for a big American city. He picked Pittsburgh, which has good commuting data, and projected modest changes. He filled empty mass-transit seats but added no new buses to the fleet and doubled carpooling from 9 to 18 percent of commuters, with a carpool defined as two people. He also factored in a jump in "eco-driving."

The stats are in. The drop in greenhouse gases for the "what if" day in Pittsburgh would equal taking 370 cars off the world's roads for a year. And cars would burn 213,700 fewer gallons of gas. At $2.50 a gallon, that's $534,250 in Pittsburghers' pockets. *—Marc Silver*

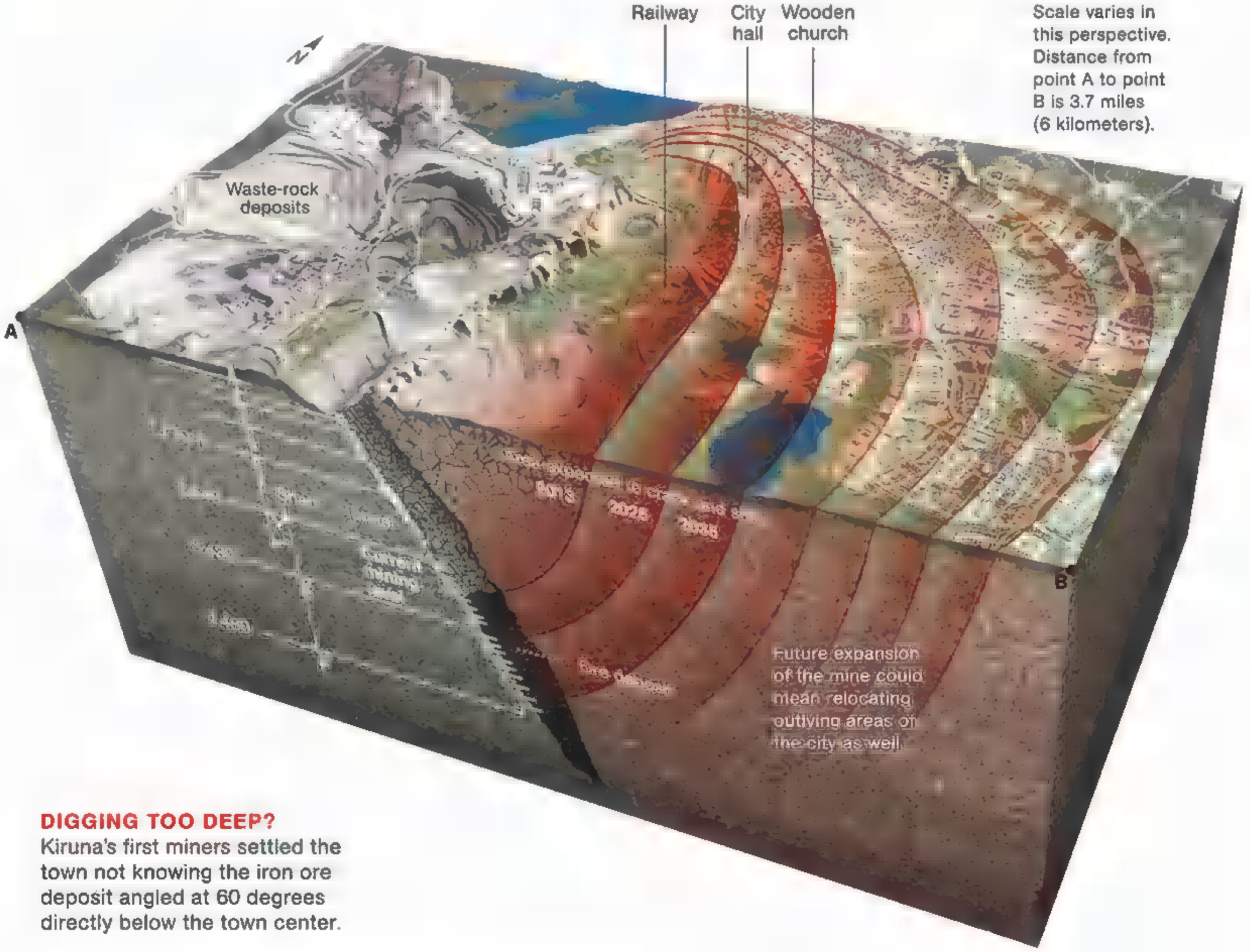
GRAPHIC: MINDY NICHAMIN. SOURCES: LUKE TONACHEL, NATURAL RESOURCES DEFENSE COUNCIL; MOVING COOLER STUDY, CAMBRIDGE SYSTEMATICS; 2007 AMERICAN COMMUNITY SURVEY, U.S. CENSUS BUREAU, ANALYSIS BY SOUTHWESTERN PENNSYLVANIA COMMISSION. PHOTO: RICHARD DRDUL

Town on the Move Ninety miles above the Arctic Circle, the Swedish municipality of Kiruna is in trouble. The town center, population 18,000, sits atop one of the world's largest iron ore mines. After 110 years of mining and more than a billion tons of ore, huge cracks deform the bedrock, and Kiruna must either see the mine shut down or move out of harm's way.

What to do? Well, move, of course. Residents, many of whom depend on the mine for jobs, have decided to gradually relocate central houses, shops, and even a 98-year-old wooden church (below) to more stable ground several miles away. Some buildings will be transported brick by brick; many will be constructed anew. Among the first to go: the 1899 house of Kiruna's founder. Railroad tracks, roads, and electricity lines have already started to migrate. The iron mine, key to new Kiruna's survival, will remain active—but at a safer distance. *—Hannah Bloch*



The relocation of Sweden's northernmost city will take place over the next century.



DIGGING TOO DEEP?
Kiruna's first miners settled the town not knowing the iron ore deposit angled at 60 degrees directly below the town center.

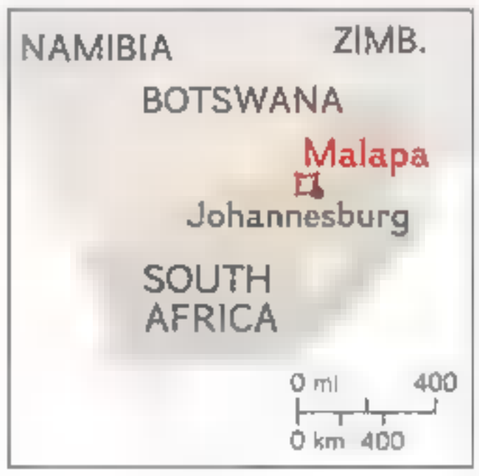
GRAPHIC: CHUCK CARTER AND HIRAM HENRIQUEZ; MARIEL FURLONG, NGM STAFF
SATELLITE IMAGE: DIGITALGLOBE. SOURCE: KIRSTEN HOLME AND ANDERS LINDBERG, LKAB. PHOTO: TOMAS UTSI. NGM MAPS

This juvenile skull from Malapa cave emerged once the surrounding limestone was teased away.

A Revealing Relative

Finds at Malapa cave in South Africa may provide a big piece to an unsolved puzzle of human evolution. Paleoanthropologist Lee Berger of the University of the Witwatersrand and his team discovered two fossil skeletons of a previously unknown human ancestor there, embedded in limestone almost two million years old. The new species, *Australopithecus sediba*, lived when human ancestors were evolving from more primitive australopiths toward our direct ancestor, *Homo erectus*. The small brain and long arms of *A. sediba* are like those of an australopith, but the shapes of its teeth and brain case are like those of *Homo*. Until now the bones of early hominin species known from this period were few and fragmentary.

"The origin of *Homo* is the question of the decade," says Susan Antón, a physical anthropologist at New York University. "Anyone working on that question will have to take these new fossils into account." Berger hopes for more—that the fossils solve the puzzle once and for all. *—Christopher P. Sloan*



Malapa is part of an extensive system of fossil-rich caves near Johannesburg, South Africa.

PHOTO: BRETT ELOFF, NGM MAPS

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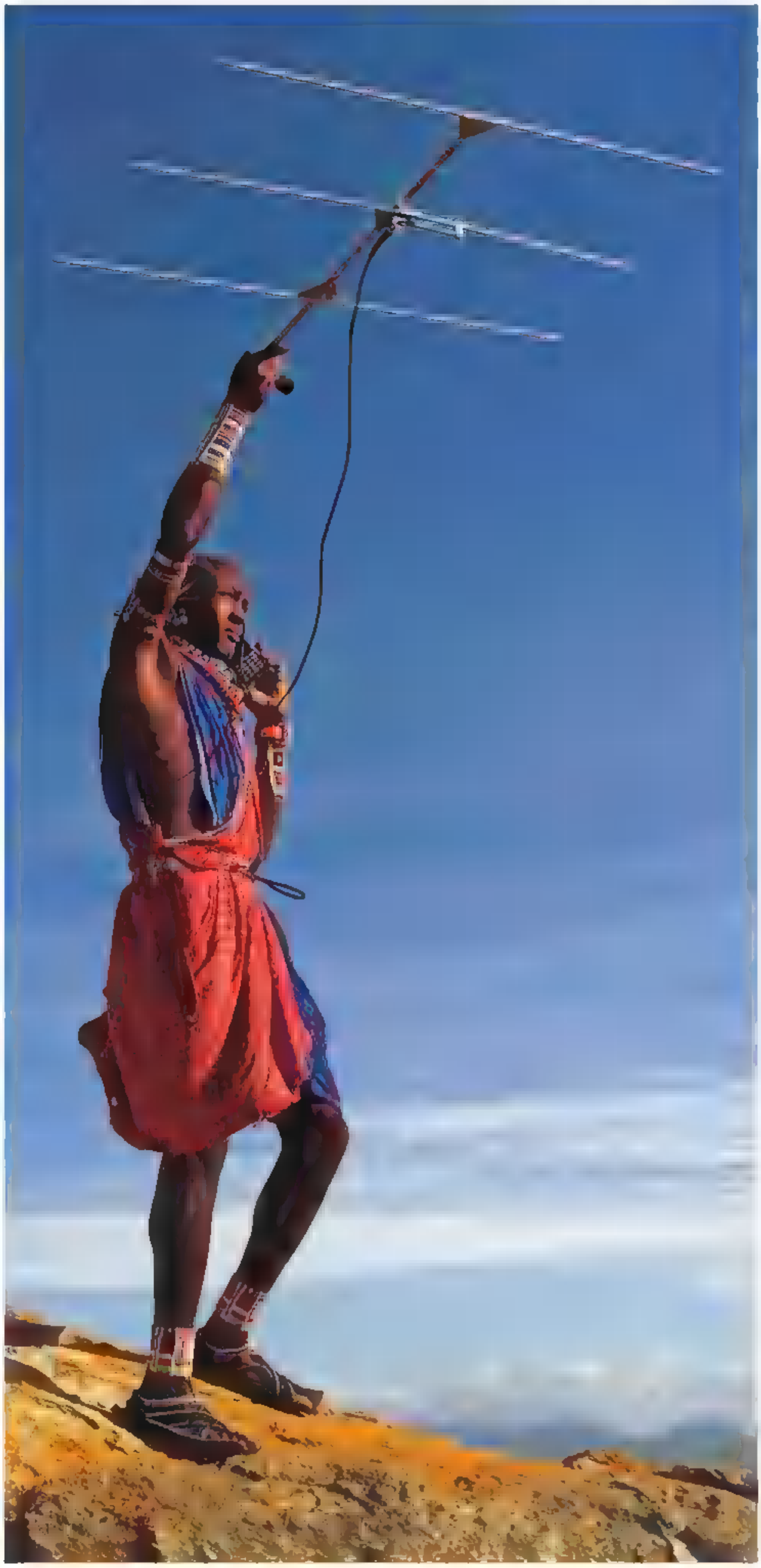
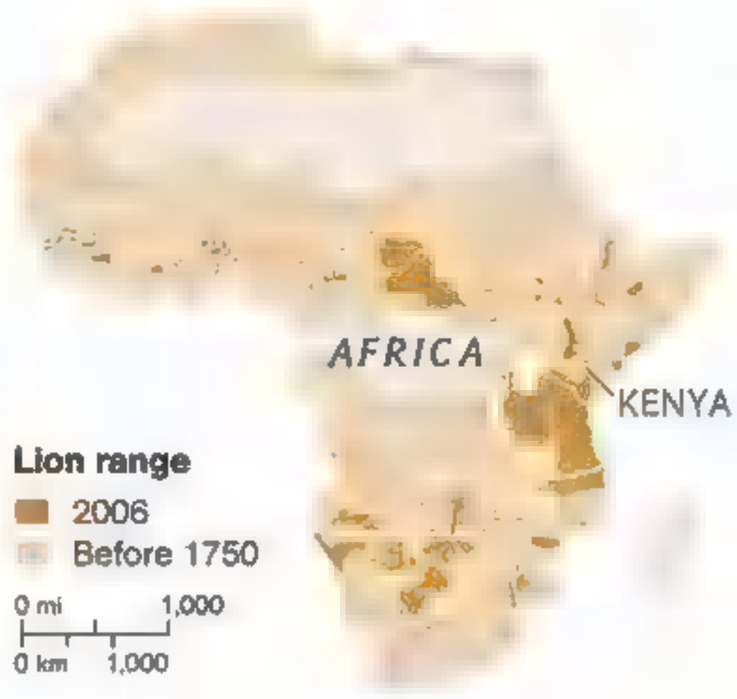


A Maasai warrior in southern Kenya raises an antenna to find a radio-collared lion. National Geographic's Big Cats Initiative is working to save lions too. Learn more at *nationalgeographic.com/bigcats*.



Guarding Lions

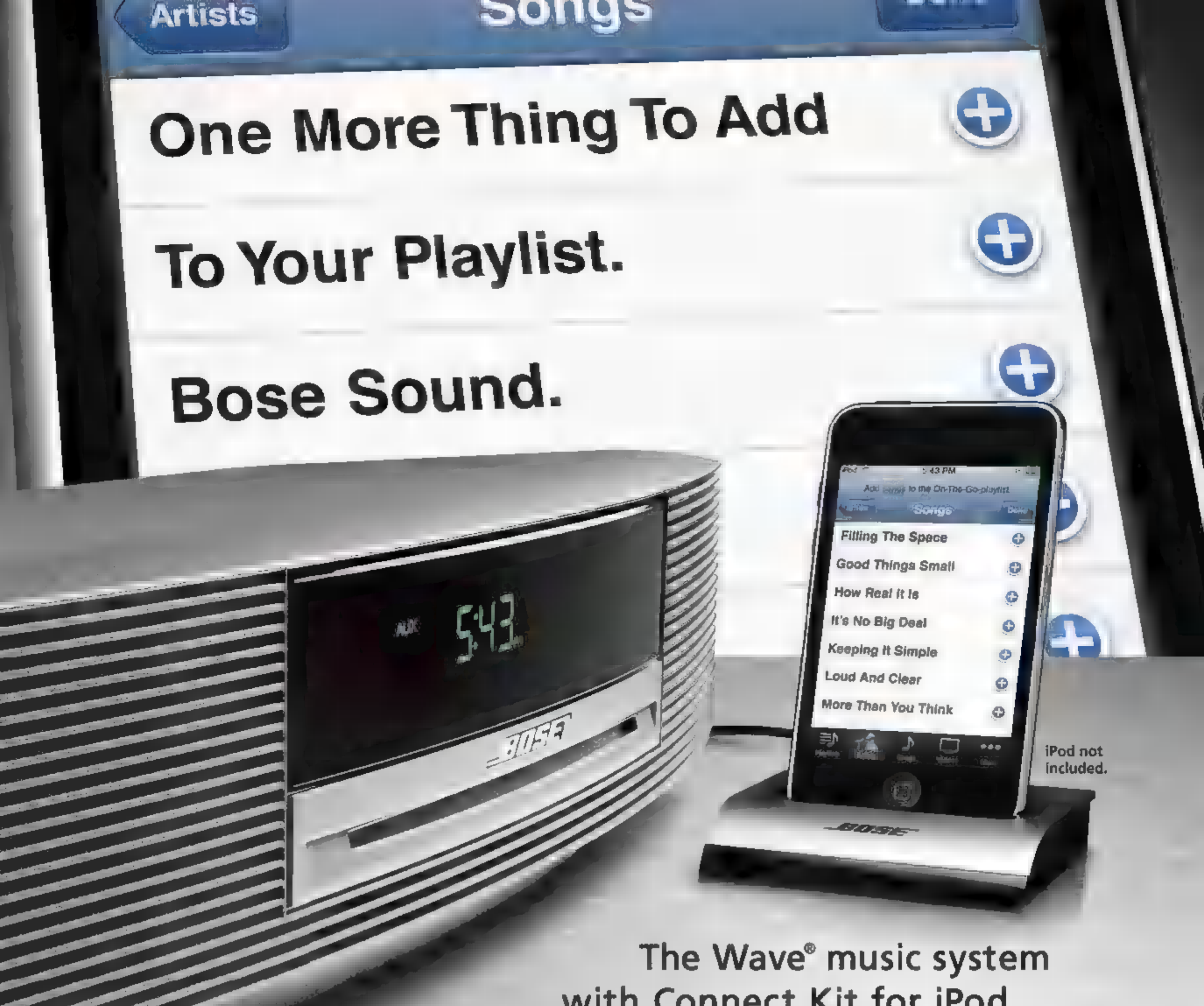
Spearing lions used to be a rite of passage for young Maasai men. Now some warriors are guarding the big cats instead.

As Africa's exploding human populations vie with wildlife for land and resources, the number of lions speared, shot, snared, and poisoned has soared,

imperiling the species. As few as 20,000 now remain. In response, Living With Lions, funded by the NGO Panthera, has hired tribesmen to protect their former foes. Warriors track lions, help cattle owners build lion-proof corrals, and educate Maasai communities on lions' value. One study in Kenya found that each cat kills livestock worth $290 a year, yet brings in $17,000 in tourist revenue.

Nevertheless, some experts warn that within 25 years there may be no lions left outside of the biggest, best run parks. Wildlife biologist Craig Packer says for lions to survive, parks must be fenced and heavily guarded—perhaps by the United Nations. *—Karen E. Lange*

PHOTOS: SEAMUS MACLENNAN (LEFT); AMY HOWARD
NGM MAPS. SOURCE: PANTHERA/WILDLIFE CONSERVATION SOCIETY



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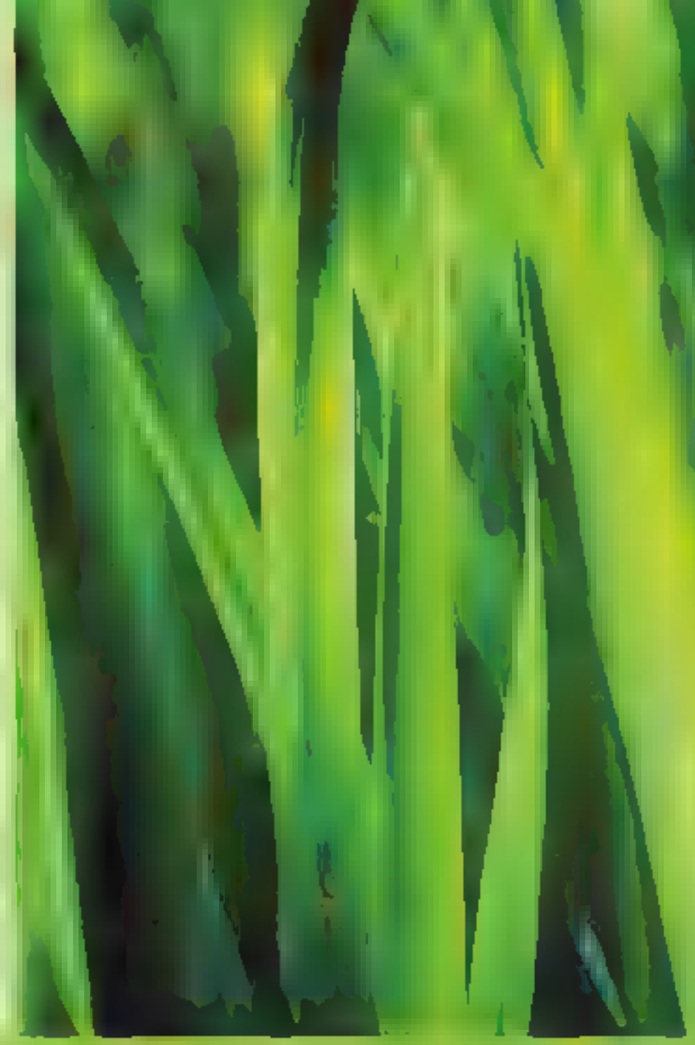

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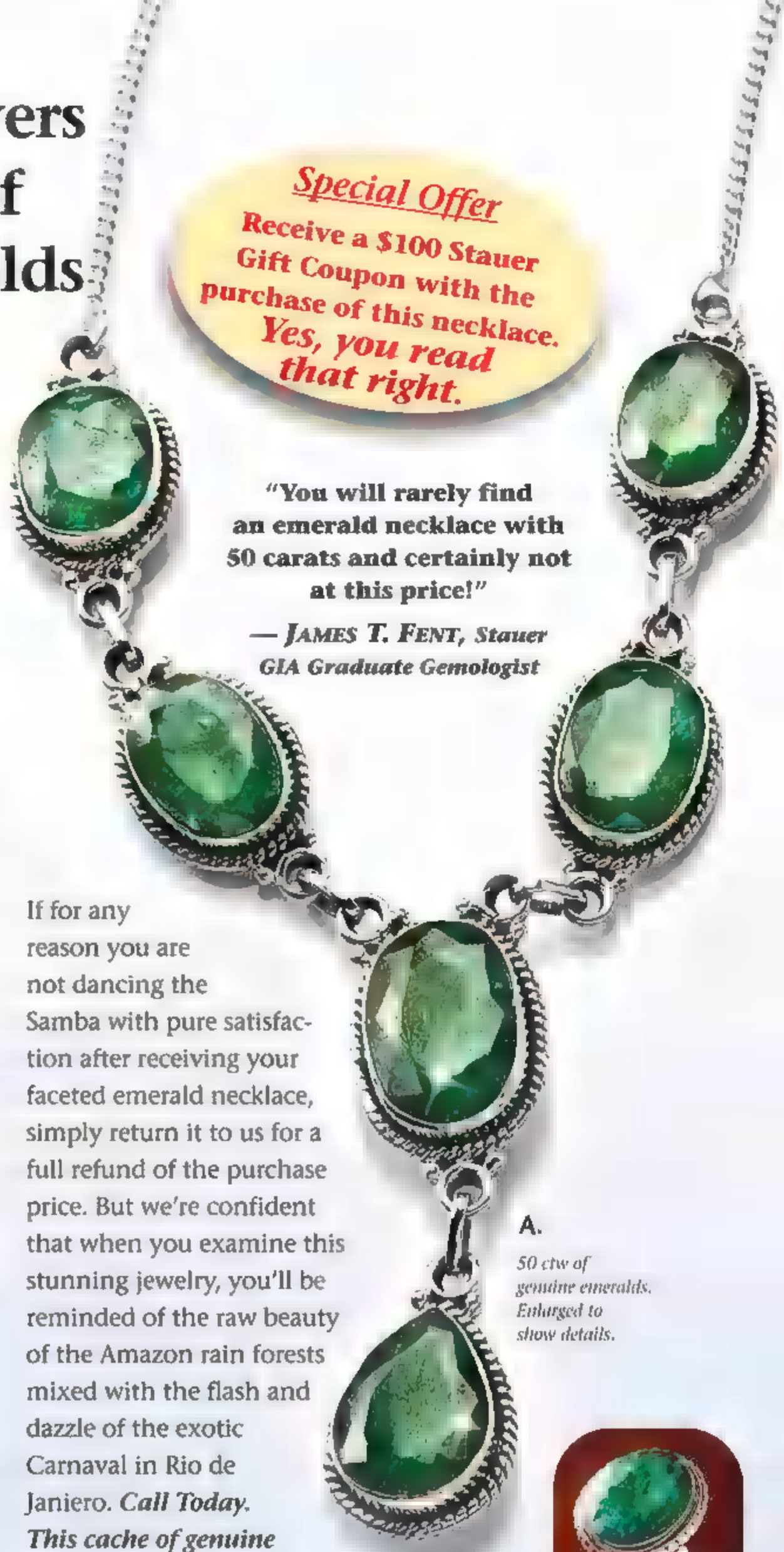

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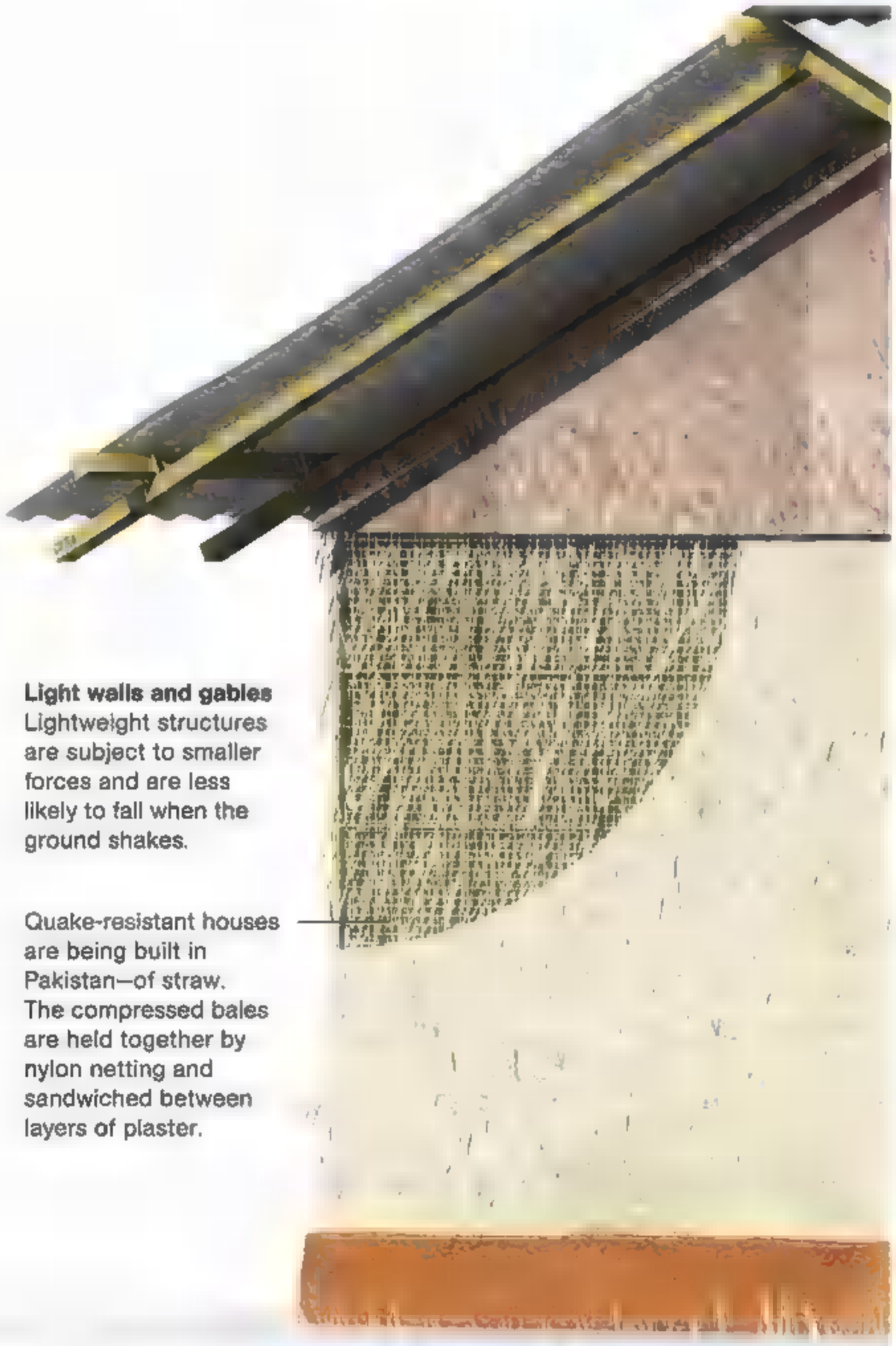
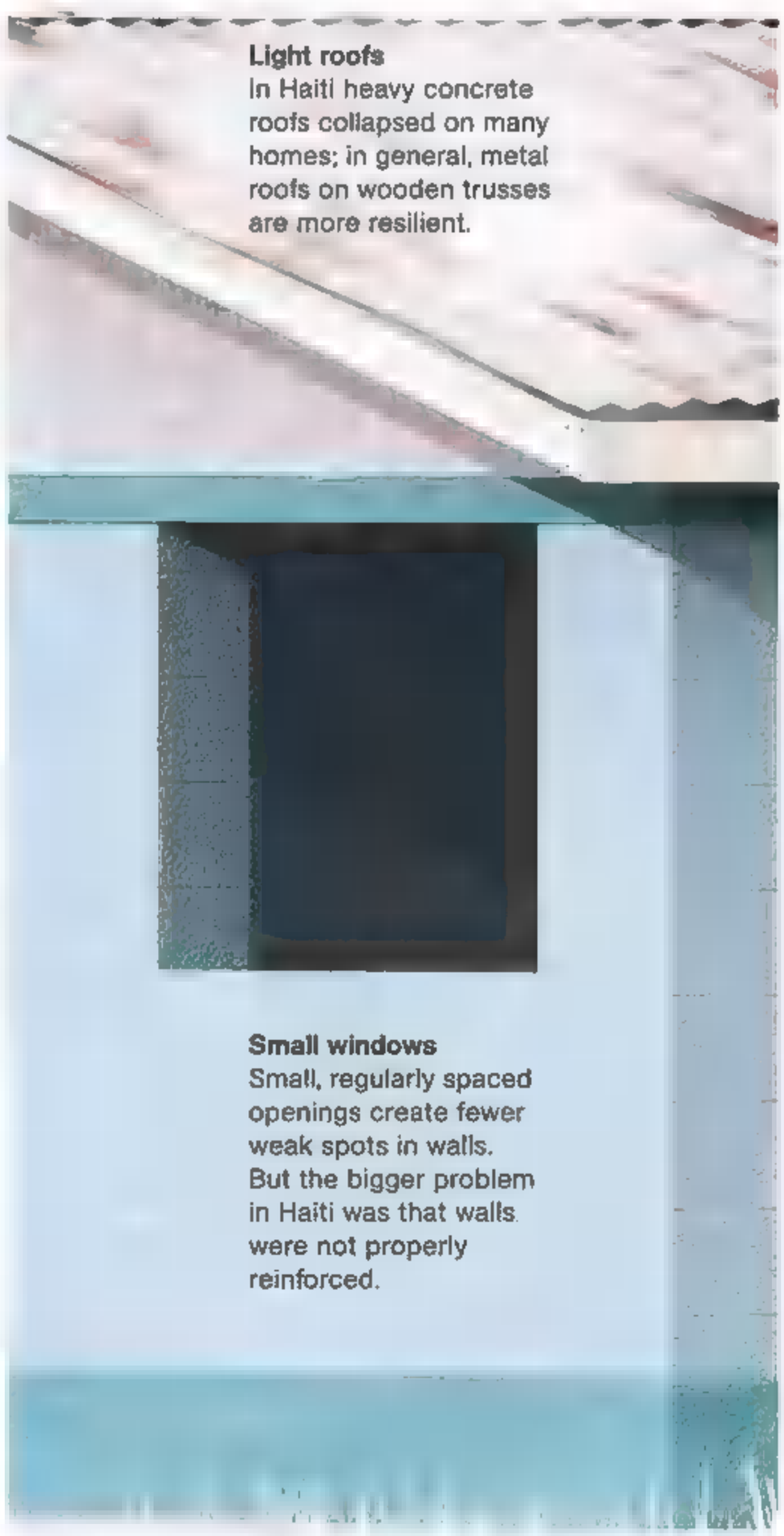
The earthquake in Haiti was a reminder: Billions of people live in houses that can't stand shaking. Yet safer ones can be built cheaply—using straw, adobe, old tires—by applying a few general principles.

	Pakistan	Haiti
MOST DESTRUCTIVE QUAKE	October 8, 2005	January 12, 2010
LOCATION	Northern Pakistan/Kashmir	Port-au-Prince area
MAGNITUDE	7.6	7.0
FATALITIES	75,000	222,500



Light walls and gables
Lightweight structures are subject to smaller forces and are less likely to fall when the ground shakes.

Quake-resistant houses are being built in Pakistan—of straw. The compressed bales are held together by nylon netting and sandwiched between layers of plaster.



Light roofs
In Haiti heavy concrete roofs collapsed on many homes; in general, metal roofs on wooden trusses are more resilient.

Small windows
Small, regularly spaced openings create fewer weak spots in walls. But the bigger problem in Haiti was that walls were not properly reinforced.

In Los Angeles, Tokyo, and other rich cities in fault zones, the added expense of making buildings earthquake resistant has become a fact of life. Concrete walls are reinforced with steel, for instance, and a few buildings even rest on elaborate shock absorbers. Strict building codes were credited with saving thousands of lives when a magnitude 8.8 quake hit Chile in late February. But in less developed countries like Haiti, where a powerful quake in January killed some 222,500 people and left more than a million homeless, conventional earthquake engineering is often unaffordable. "The devastation in Haiti wouldn't happen in a developed country," says engineer Marcial Blondet of the Catholic University of Peru, in Lima. Yet it needn't happen anywhere. Cheap solutions exist.

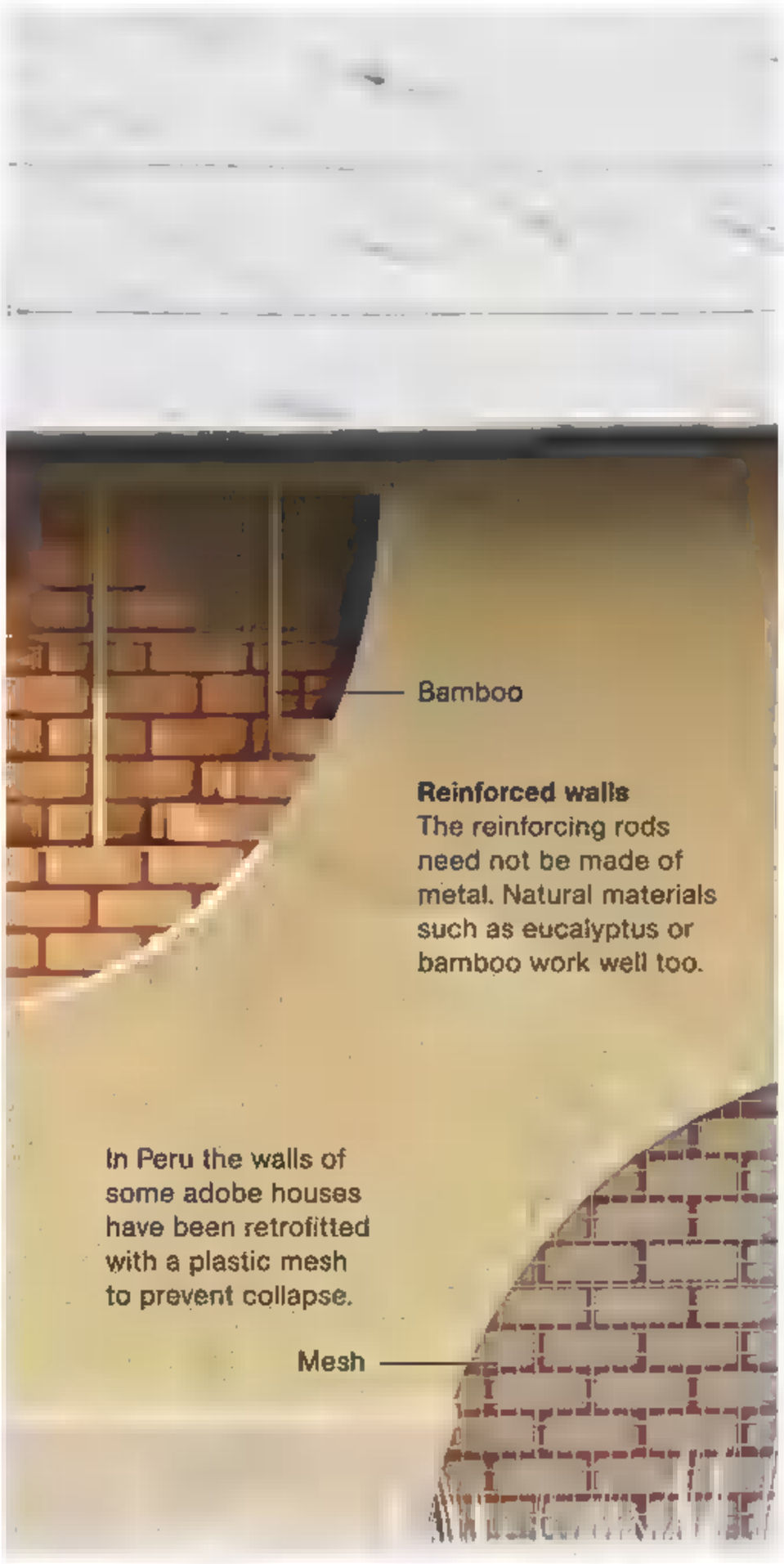
Blondet has been working on ideas since 1970, when an earthquake in Peru killed 70,000 or more, many of whom died when *(Continued on next page)*

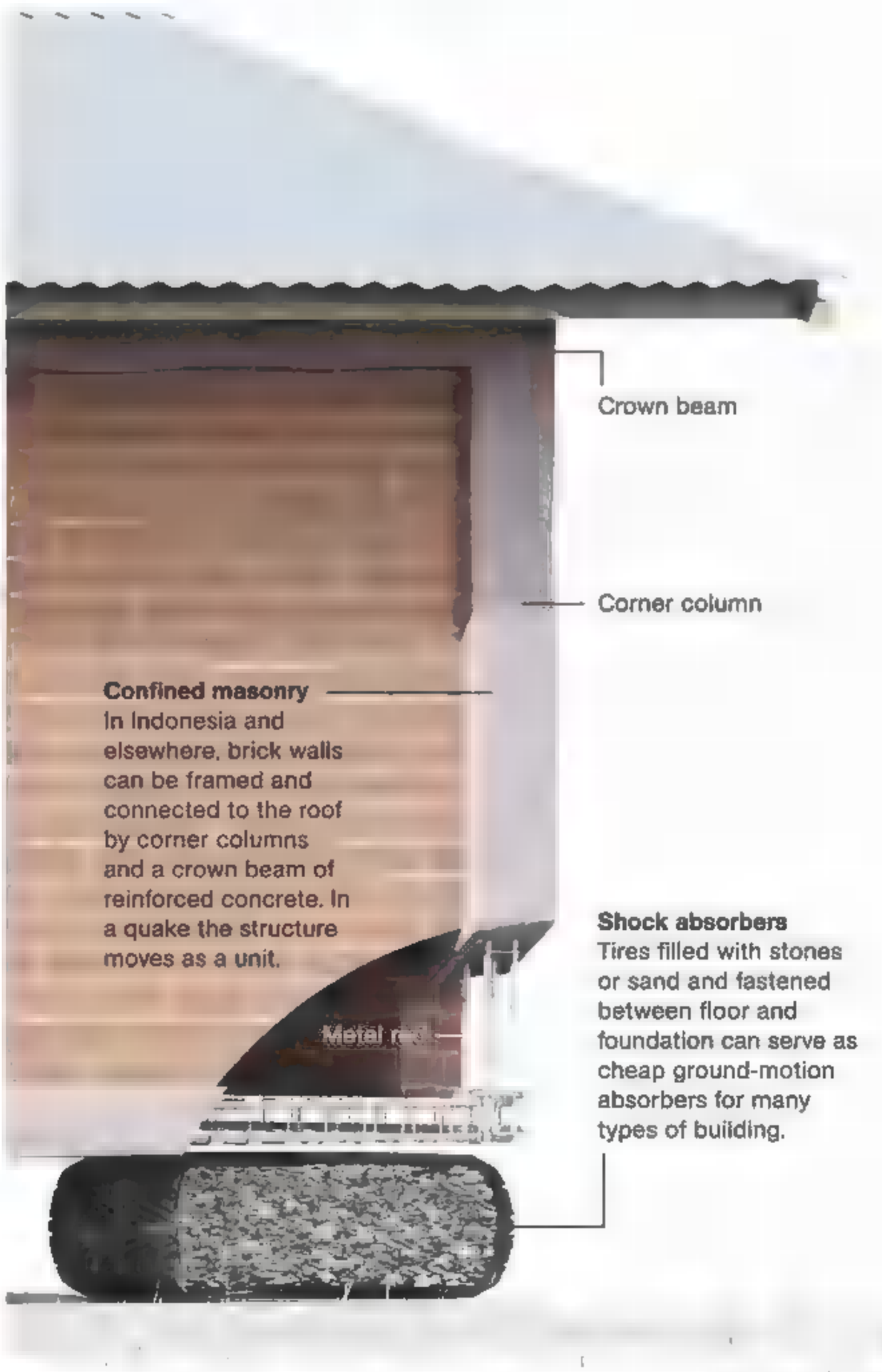
Peru

May 31, 1970
Chimbote
7.9
70,000

Indonesia

December 26, 2004
Sumatra
9.1
227,900 (includes global tsunami deaths)





ART: BRYAN CHRISTIE

SOURCES: GERNOT MINKE, UNIVERSITY OF KASSEL; ELIZABETH A. HAUSLER, BUILD CHANGE; ANNA LANG, UNIVERSITY OF CALIFORNIA, SAN DIEGO; MARCIAL BLONDET AND ALVARO RUBIÑOS, CATHOLIC UNIVERSITY OF PERU; PIERRE PAUL FOUCHÉ, UNIVERSITY AT BUFFALO; USGS

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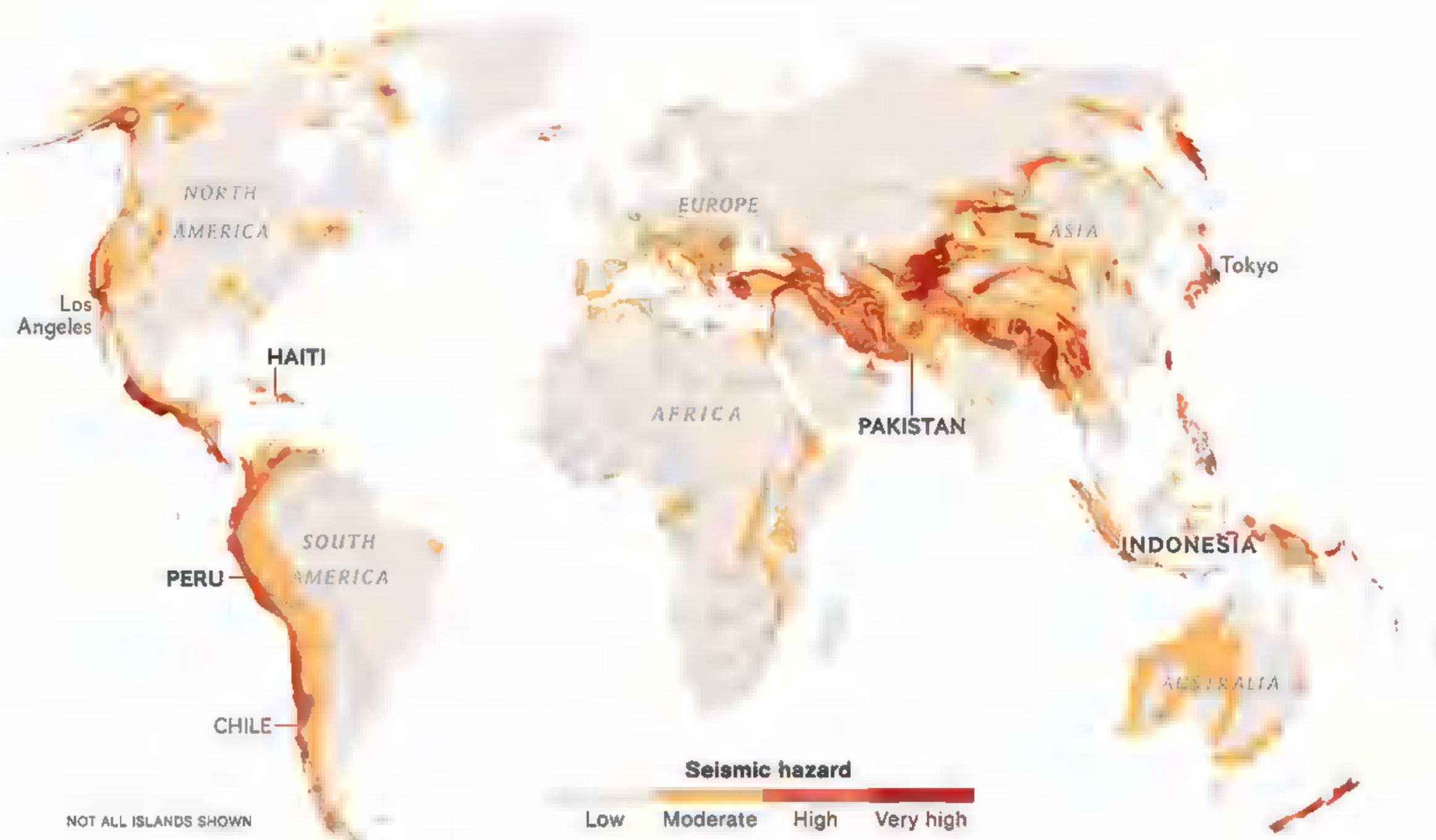
THE BIG IDEA

Hazard Zones Many of the zones where the most intense earthquakes are likely to occur lie in less developed countries. It's not the violent shaking of the ground itself that claims the most victims, but the collapse of poorly constructed buildings.



their houses crumbled around them. Heavy, brittle walls of traditional adobe—cheap, sun-dried brick—cracked instantly when the ground started bucking. Subsequent shakes brought roofs thundering down. Blondet's research team has found that existing adobe walls can be reinforced with a strong plastic mesh installed under plaster; in ■ quake, those walls crack but don't collapse, allowing occupants to escape. "You rebuild your house, but you don't bury anyone," Blondet says. Plastic mesh could also work as a reinforcement for concrete walls in Haiti and elsewhere.

Other engineers are working on methods that use local materials. Researchers in India have successfully tested a concrete house reinforced with bamboo. A model house for Indonesia rests on ground-motion dampers designed by John van de Lindt of Colorado State University: old tires filled with bags of sand. Such a house might be only a third as strong as one built on more sophisticated shock absorbers, but it would also cost much less—and so be more likely to get built in Indonesia. "As an engineer you ask, What level of safety do I need?" van de Lindt says. "Then you look at what's actually available and find the solution somewhere in between."

In northern Pakistan, straw is available. Traditional houses are built of stone and mud, but straw is far more resilient, says California engineer Darcey Donovan, and warmer in winter to boot. Donovan and her colleagues started building straw-bale houses in Pakistan after the 2005 earthquake; so far they have completed 17.

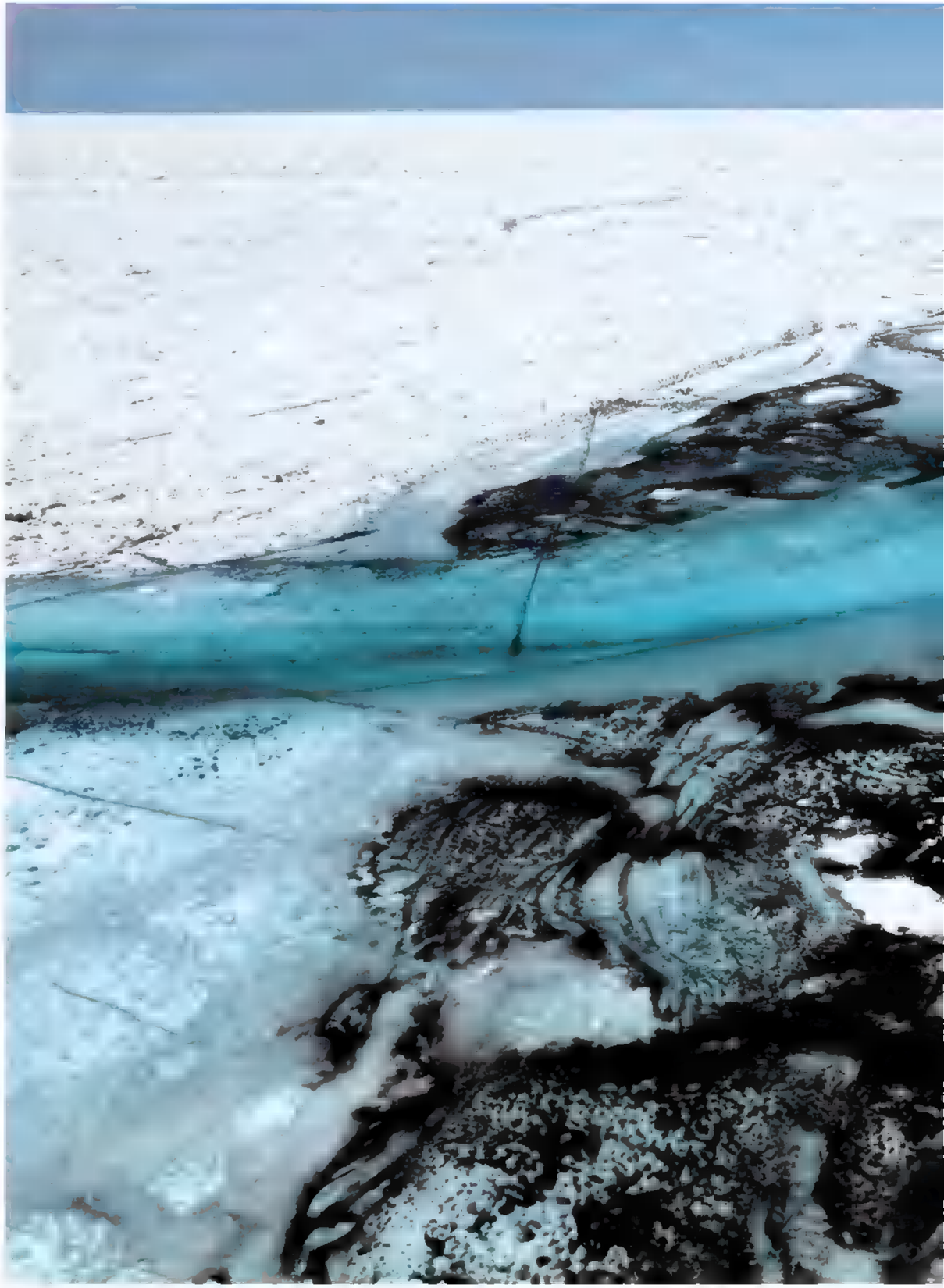
The same stark contrast prevails in other fault zones: encouraging ideas, discouraging progress. Even cheap ideas aren't always cheap enough. Since 2007 some 2,500 houses in Peru have been strengthened with plastic mesh or other reinforcements, with another 700 scheduled for this year. That leaves millions of houses and billions of dollars to go in Peru alone, to say nothing of other countries. "There are many millions of houses around the world," Blondet says, "that will collapse in the next earthquake." *—Chris Carroll*

NGM MAPS. SOURCE: GLOBAL SEISMIC HAZARD ASSESSMENT PROGRAM

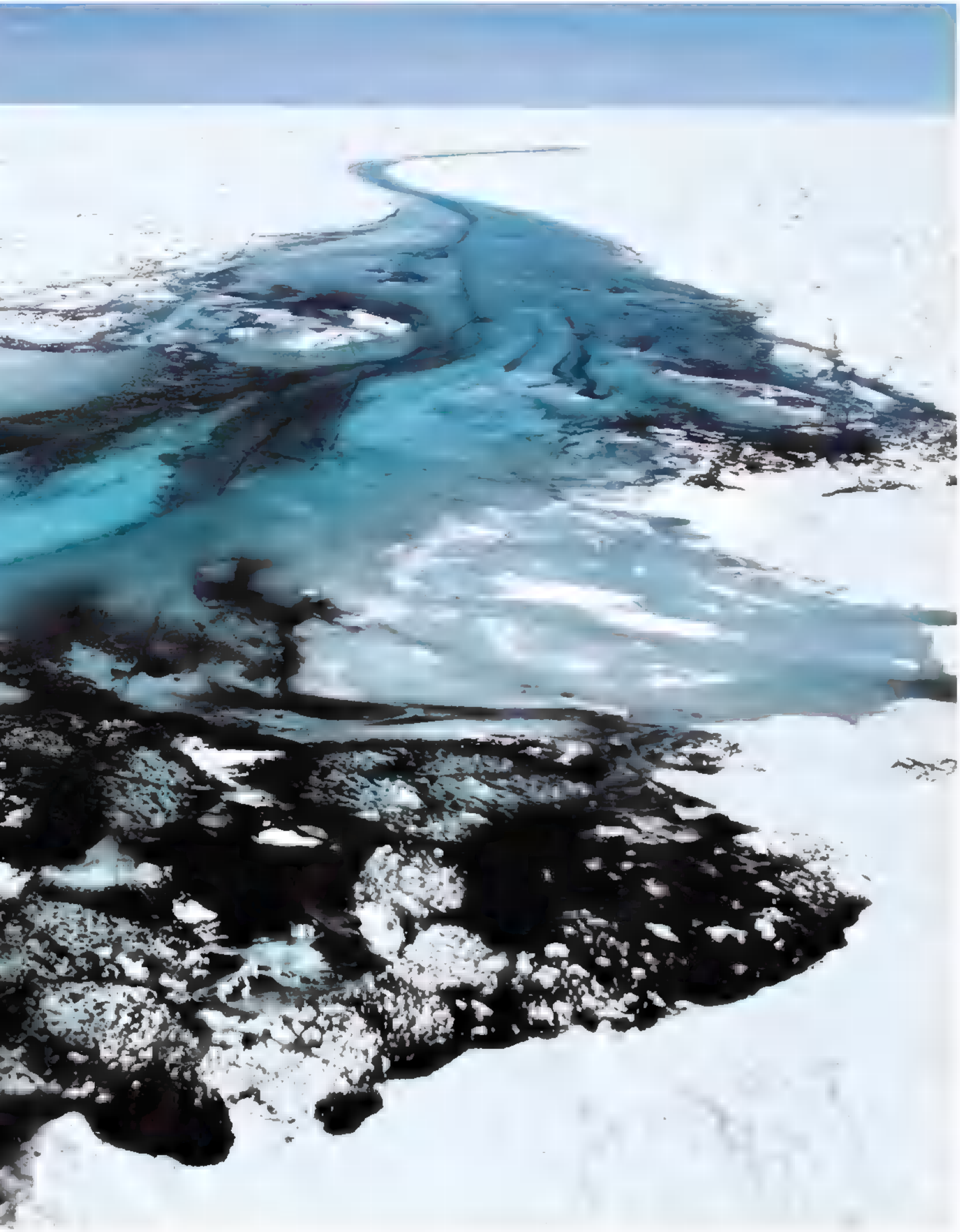
True Colors

THE CHANGING FACE OF GREENLAND

There's a meltdo... the ice sheet—and optimism among Greenland...

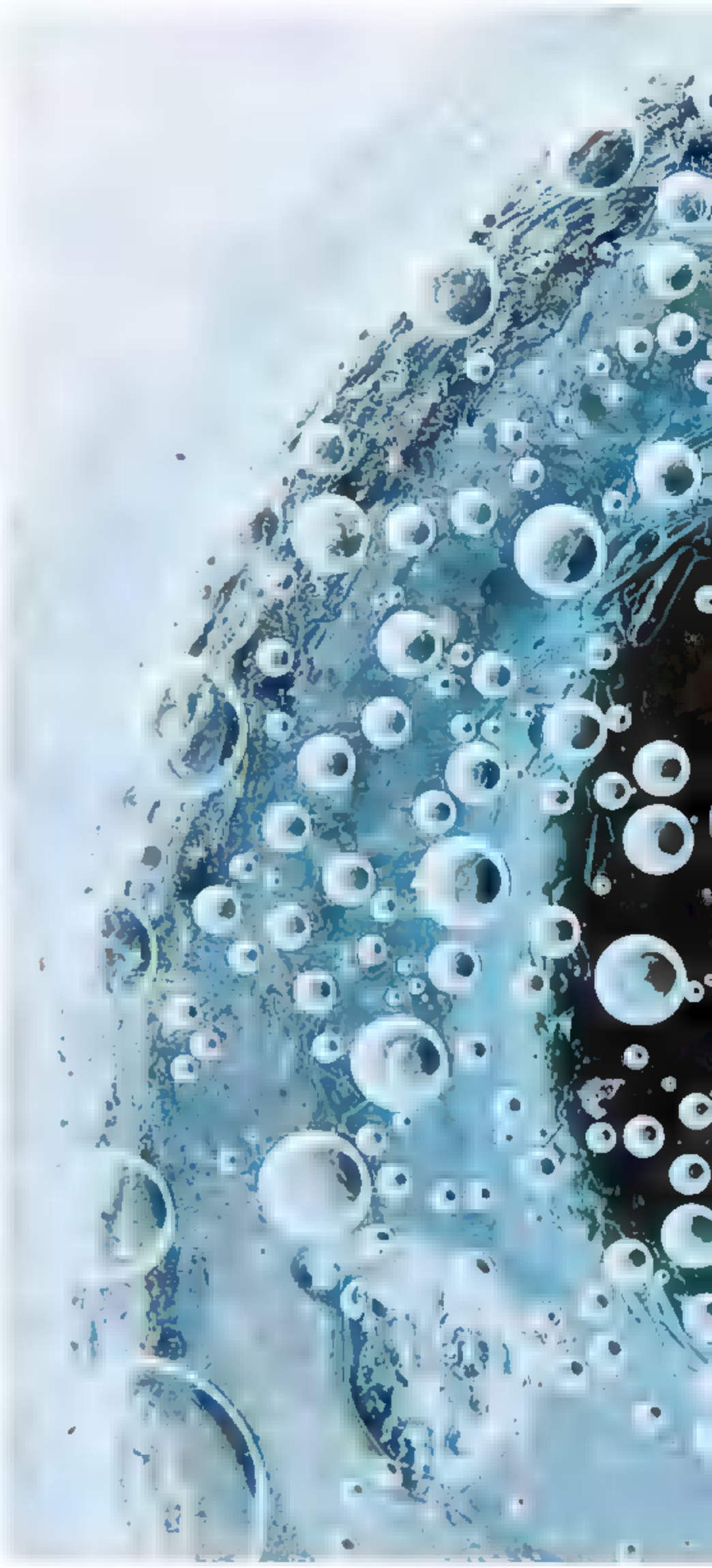


Preceding pages: Meltwater has carved a canyon 150 feet deep. At left, a field assistant rappels into the depths of a crevasse. The bottom of the crevasse could open into a vertical shaft, or moulin, through which a lake on the surface might drain to the depths of the ice



sheet. The black splotches mingled with ice and meltwater, above, are cryoconite—powdery debris blown to Greenland from often distant deserts, fires, coal plants, and diesel engines. Cryoconite reduces the ice's albedo, or reflectivity, allowing increased absorption of solar heat.

BY MARK JENKINS
PHOTOGRAPHS BY JAMES BALOG



At first glance Greenland is an expanse of blinding white. But as my chopper swings low over the island, color catches my eye.

For miles on end, bands of blue meltwater fringe the ice sheet. Fields of white are threaded with rivers, etched with crevasses, and blotched with lakes. There is also ice that appears neither white nor blue but rather brown and even black—darkened by a substance called cryoconite. This muddy-looking grit is a key topic of investigation for my four companions: photographer James Balog with his assistant, Adam LeWinter, and geophysicist Marco Tedesco with Ph.D. student Nick Steiner, both from the City College of New York.

Balog photographs ice—and the absence of it. He founded the Extreme Ice Survey (EIS) in 2006 "to create a memory of things that are disappearing," he says. EIS has deployed more than 35 solar-powered, blizzard-proof, time-lapse cameras aimed at glaciers in Alaska, Montana, Iceland, and Greenland—all of them snapping away day in and day out. Programmed to take 4,000 to 12,000 frames a year, they're making a constant record, like "little surrogate eyes out there watching the world for us," Balog says.

We set up camp 45 miles inland from the west coast village of Ilulissat, in a portion of Greenland's melt zone where the weathering of the top layers of the ice sheet exposes what is known as blue ice. This ancient ice is compressed to the point where most air bubbles—which normally refract light to give ice a milky or white appearance—have been squeezed out. With fewer bubbles, the ice absorbs light from the red end

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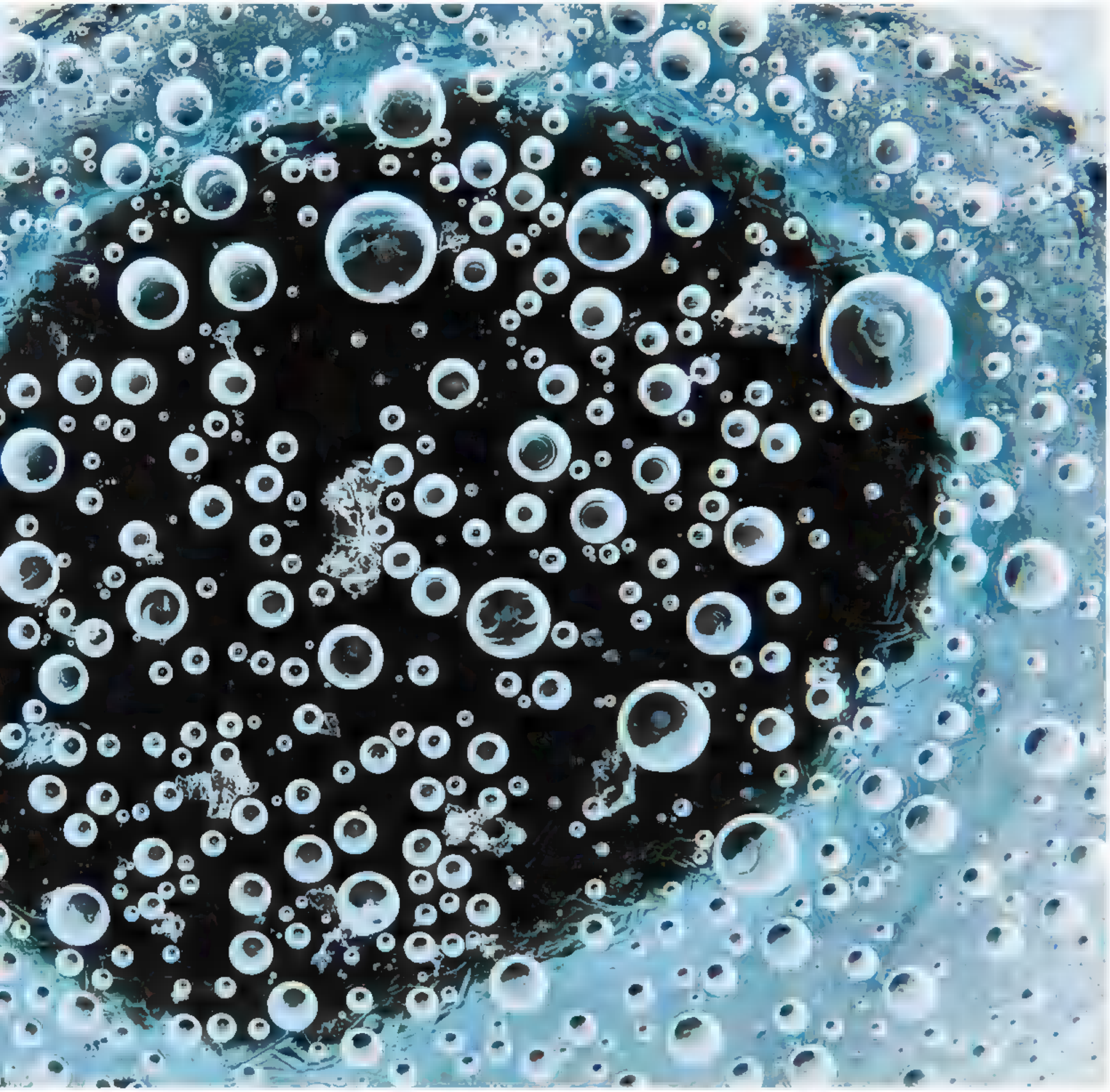
Mark Jenkins wrote about the Tea Horse Road in the May issue. Photographer James Balog is a regular contributor to National Geographic publications.



In a pothole burned into the ice by cryoconite, buried air and gas from bacteria and algae bubbled to the surface, where a midnight freeze trapped them.

of the spectrum, leaving the blue to be reflected. Depending on the tricks sunlight plays, blue ice can also appear white, as it does in many places around us.

The camp stands beside a vast meltwater lake. Tedesco and Steiner study its depth, planning to compare their information with satellite readings of the depths of Greenland's supraglacial lakes. Each morning they launch a small craft to collect data. The vessel is a bait boat retrofitted with remote control, sonar, a laptop-driven spectrometer, GPS, a thermometer, and an underwater camera.

Greenland's meltwater lakes are prone to draining unexpectedly and quickly (thus Tedesco's unmanned research vessel). Balog once watched a lake drain overnight. The bottom of a moulin—a vertical shaft in the ice—opened up and sucked the entire lake into oblivion. In 2006 a team led by glaciologists from Woods Hole Oceanographic

Institution and the University of Washington documented the draining of a two-square-mile supraglacial lake: More than 11 billion gallons of water disappeared into a moulin in 84 minutes, flowing faster than Niagara Falls.

The meltwater lake Tedesco is studying has an outlet river that must lead to a gulping moulin. LeWinter and I are determined to find it. Armed with ice axes, ice screws, and ropes, we set out. We haven't gone a quarter mile before we're stymied by holes in the ice. At first we can thread our way between them, but farther along, the rims are all touching, and we're forced to bound the pools, one knife-edge to the next. It's like playing leapfrog on razor blades.

We try an alternate route, following a ridge of ice that parallels the river. This time we make good headway and march across the ice sheet for miles. We can't find the moulin on foot, but we make an intriguing observation: On the journey out, the holes we were jumping were separate, circular bowls, but on the way back, just half a day later, there's been enough melting so that the holes are connected by swift-running creeks.

At camp that night we find out what Tedesco and Steiner have confirmed about the bottom of the meltwater lake. It is mottled with cryoconite.

Cryoconite begins as airborne sediment spread over the ice by wind. It is composed of mineral dust sucked up from as far away as Central Asian deserts, particles from volcanic eruptions, and soot. The soot particles come from fires both natural and man-made, diesel engines, and coal-fired power plants. Cryoconite is not a new phenomenon: Arctic explorer Nils A. E. Nordenskiöld discovered and named the fine brown silt during his visit to the Greenland ice sheet in 1870. Human activities have increased the amount of black soot in cryoconite since Nordenskiöld's day, and global warming has given it new importance.

Carl Egede Bøggild is a native Greenlander and geophysicist who has spent the past 28 years studying the ice sheet. Recently Bøggild has focused on cryoconite. "Even though cryoconite

Society Grant This project was funded in part by your National Geographic Society membership.

Summer meltwater collects in a lake (left). Days later the water has drained through a snow-covered channel after a moulin opened under the ice several miles away.

is composed of less than 5 percent soot," he says, "it is the soot that causes it to turn black." The darkness decreases the albedo, or reflectivity, of the ice, which increases the absorption of heat; that in turn increases the amount of melting.

Snow falls each year on the ice sheet along with a dusting of cryoconite. As each year's snow cover hardens, it traps the dust. When summers are particularly warm, as they have been in recent years, multiple layers of ice melt, releasing extra amounts of trapped cryoconite, which creates a more concentrated, darker layer of the substance at the surface. "What we have is a vicious, constantly accelerating cycle," Bøggild says. "It's like pulling a black curtain over the ice."

Even during our short expedition, it seems as if we are seeing that effect. In just a week, melting ice has turned our camp into a slushy quagmire. Somewhere in the distance, the meltwater lake has drained into the moulin we had searched for. It's been like witnessing the creation of an ice analogue for Utah's canyonlands, the geologic clock ridiculously sped up. Balog's time-lapse cameras have captured it all. "They're recording the heartbeat of the planet," he says.

Before the expedition departs, Balog persuades me to descend into a moulin right next to camp—one of the largest the EIS team has discovered in its 11 expeditions to Greenland. It is big enough to swallow a freight train—certainly big enough to swallow me. Still, I cannot resist rappelling into the maw of this chasm that Balog has dubbed "the beast."

On rimed ropes, I drop in. A hundred feet down the shaft, walls of blue ice surround me, and I am soaked with frigid spray. The blue Arctic sky above is framed by jagged three-story icicles. Below, vanishing into the abyss, is the thundering waterfall that bored this shaft.

Scientists have dumped yellow rubber duckies, sensored spheres, and huge quantities of dye into moulins, hoping to track their journeys and discover where along Greenland's coast the moulins empty. Some of the spheres and dye have been spotted; all the duckies disappeared. I am tempted to drop deeper, investigate further, but I think again. After 20 minutes hanging by my rope, I climb back out. □

author Mark Jenkins s
a moulin 96 feet deep. As melting
continues, cryoconite dust scattered
on the surrounding ice will likely
converge into a darker patch, cre-
ating another hot spot for ice loss.

Vanishing Ice

Greenland's ice sheet once seemed too big to melt substantially. Now, as weather warms, the ice is disintegrating faster. Scientists think this could continue for centuries or even millennia, changing the island's geography and the planet's sea level.

Melting Down

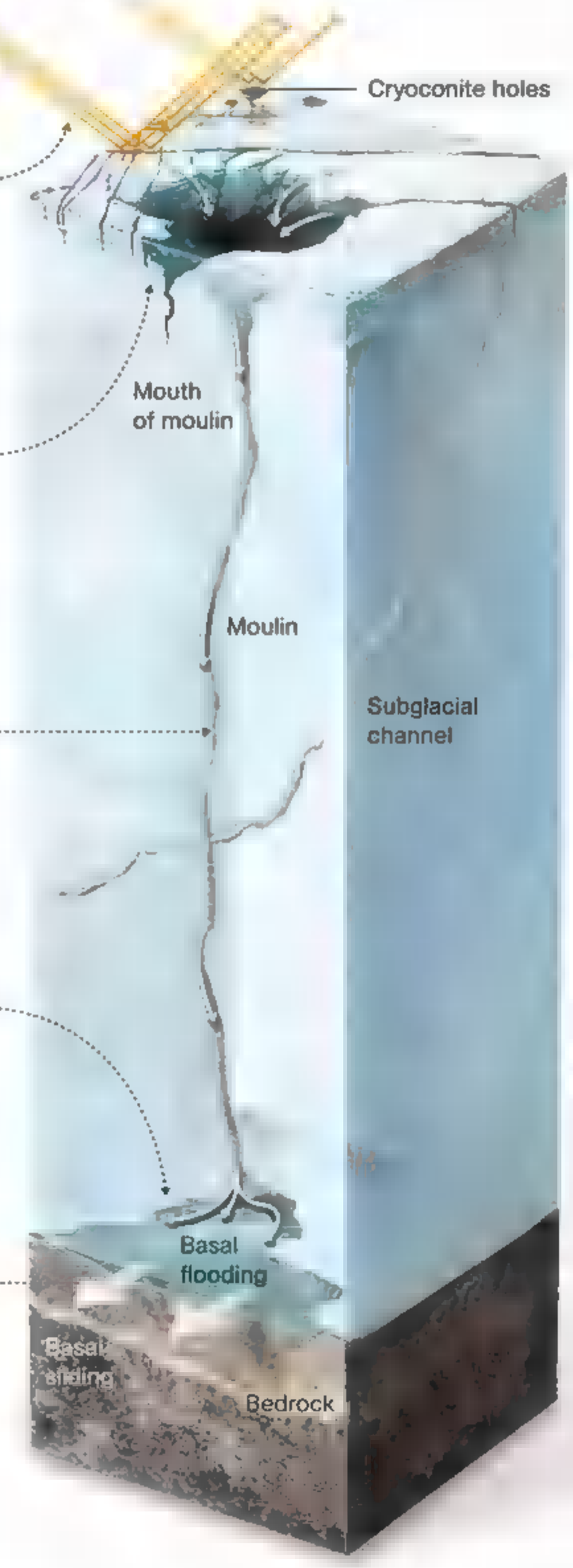
SOLAR RADIATION
As average summer temperatures rise in Greenland, more ice melts. Surface water and dark cryoconite absorb solar heat, speeding melting.

CREVASSE
A crack, or crevasse, that forms as the ice moves over uneven bedrock can plunge hundreds of feet. A flood of meltwater can drill it even deeper.

MOULIN
A shaft, or moulin, forms when meltwater weakens ice and suddenly flushes to unseen depths from the bottom of a surface lake or via a crevasse.

HYDRAULICS BELOW
The ice travels on a thin layer of water. When a draining moulin floods the base of the ice sheet, the ice begins to surf on that water and picks up speed.

THE WATER'S JOURNEY
Meltwater that works its way to the bedrock eventually turns into rivers that can carve ice tunnels many feet high as they flow to the sea.



Ice thickness at the outer edge of the melt area averages 1,500 feet.

ALEJANDRO TUMAS AND TONY SCHICK
ART: CHUCK CARTER

SOURCES: KONRAD STEFFEN AND WALEED ABDALATI, UNIVERSITY OF COLORADO AT BOULDER; SRIDHAR ANANDAKRISHNAN, PENNSYLVANIA STATE UNIVERSITY; CENTER FOR REMOTE SENSING OF ICE SHEETS, UNIVERSITY OF KANSAS; JOSHUA MEISEL, HASKELL INDIAN NATIONS UNIVERSITY; GLAS/ICESAT, NATIONAL SNOW AND ICE DATA CENTER; PAUL MORIN, UNIVERSITY OF MINNESOTA AND ANTARCTIC GEOSPATIAL INFORMATION CENTER; SHAWN MARSHALL, UNIVERSITY OF CALGARY

Origins of the Ice Sheet

50-10 million years ago
A warm climate bathed coastal mountains, rivers, and a high central plateau.

3-2 million years ago
As the climate gradually chilled, glaciers began to form in the mountains.

About 2 million years ago
The land continued to grow colder, and glaciers spread across parts of the central plateau.

Ice sheet

Maximum thickness 2 miles

Below sea level

Bedrock

GREENLAND

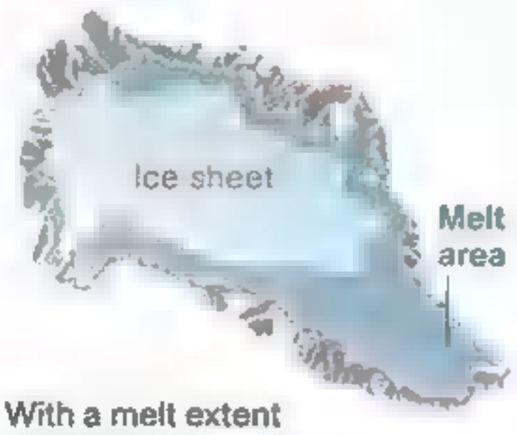
Covering some 80 percent of the island, the ice sheet measures more than 650,000 square miles. Shaped like a lens, the ice is solid at its thick center but riddled with decay around the edges.

Ice-penetrating radar offers ■ detailed look at the land below. Every summer, as the ice margins melt and glaciers slide faster into the sea, Greenland loses more than twice the amount of ice in the European Alps.

Annual Melt Area

Almost three decades of satellite data reveal an escalating trend in the extent of the ice-melt zone—the part of the ice sheet where melting occurs between April and October. The rest of the year, the entire ice sheet is frozen. Even during the warmer months much of the ice refreezes overnight.

2007



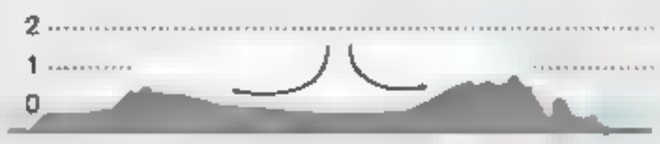
With a melt extent of at least 40 percent, 2007 set a record.

Scenarios for the year 2100
Climate change projections

Medium Estimate:
4.5°F rise in global temperature

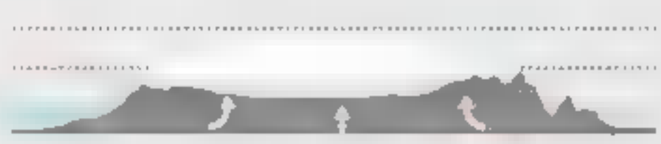
High Estimate:
9°F rise in global temperature

2-1 million years ago
Separate glaciers merged to form a sheet of solid ice that covered most of the island most of the time.



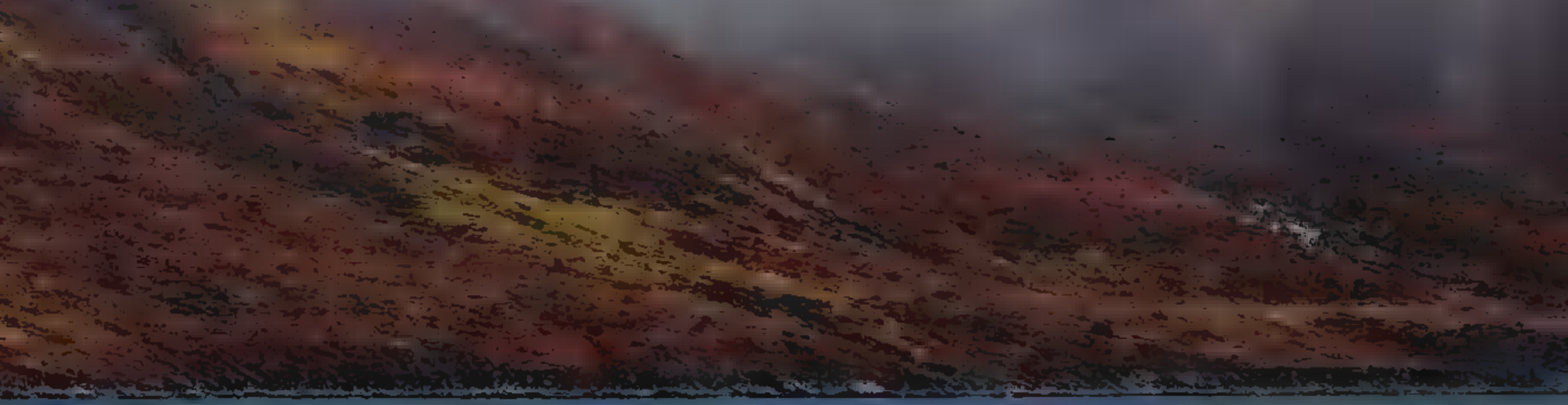
The solid ice sheet has depressed underlying rock by some 3,000 feet. Its weight also squeezes out a thin lip of ice to the sides.

■ melting continues at its current rate, the central plateau will slowly begin to rebound as the weight of the ice lifts from it.



THE CHANGING FACE OF GREENLAND

Viking Weather



A September storm darkens Eskermini fjord

BY TIM FOLGER

PHOTOGRAPHS BY PETER ESSICK

A little north and west of Greenland's stormy southern tip, on a steep hillside above an iceberg-clotted fjord first explored by Erik the Red more than a thousand years ago, sprout some horticultural anomalies: a trim lawn of Kentucky bluegrass, some rhubarb, and a few spruce, poplar, fir, and willow trees. They're in the town of Qaqortoq, 60° 43' north latitude, in Kenneth Høegh's backyard, about 400 miles south of the Arctic Circle.

"We had frost last night," Høegh says as we walk around his yard on a warm July morning, examining his plants while mosquitoes examine us. Qaqortoq's harbor glitters sapphire blue below us in the bright sun. A small iceberg—about the size of a city bus—has drifted within a few feet of the town's dock. Brightly painted clapboard homes, built with wood imported from Europe, freckle the nearly bare granite hills that rise like an amphitheater over the harbor.

Høegh, a powerfully built man with reddish blond hair and a trim beard—he could easily be cast as a Viking—is an agronomist and former chief adviser to Greenland's agriculture ministry. His family has lived in Qaqortoq for more than 200 years. Pausing near the edge of the yard, Høegh kneels and peers under a white plastic sheet that protects some turnips he planted last month.

"Wooo! This is quite incredible!" he says with a broad smile. The turnips' leaves look healthy and green. "I haven't looked at them for three or four weeks; I didn't water the garden at all this year. Just rainfall and melting snow. This is amazing. We can harvest them right now, no problem."

It's a small thing, the early ripening of turnips on a summer morning—but in a country where some 80 percent of the land lies buried beneath an ice sheet up to two miles thick and where some people have never touched a tree, it stands for a large thing. Greenland is warming twice as fast as most of the world. Satellite measurements show that its vast ice sheet, which holds nearly 7 percent of the world's fresh water, is shrinking by about 50 cubic miles each year. The melting ice accelerates the warming—newly exposed ocean and land absorb sunlight that the ice used to reflect into space. If all of Greenland's ice melts in the centuries ahead, sea level will rise by 24 feet, inundating coastlines around the planet.

Yet in Greenland itself, apprehension about climate change is often overshadowed by great expectations. For now this self-governing dependency of Denmark still leans heavily on its former colonial ruler. Denmark pumps $620 million into Greenland's anemic economy every year—more than $11,000 for each Greenlander. But the Arctic meltdown has already started to open up access to oil, gas, and mineral resources that could give Greenland the financial and political independence its people crave. Greenland's coastal waters are estimated to hold half

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Tim Folger lives in Gallup, New Mexico; this is his first article for the magazine. Peter Essick photographed a Finnish park for the June 2009 issue.

Erik the Red killed a man in Iceland over a trifle and worshipped Norse gods until the end, but at Qassiarsuk (above), site of his Greenland farm, there is a replica of the tiny wood church he built for his wife, who converted to Christianity. A wall kept out the livestock. A cold millennium later in the same area, a soccer fan in Qaqortoq cheers his nephew's team.

Sporting a [illegible] sweater and sandals, Steve Pedersen pitches cabbage as a new crop for Greenland. He'll deliver it to a restaurant in town by kayak, the capital. The edge of the ice sheet lies just 12 miles away.

as much oil as the North Sea's fields. Warmer temperatures would also mean a longer growing season for Greenland's 50 or so farms and perhaps reduce the country's utter reliance on imported food. At times these days it feels as if the whole country is holding its breath—waiting to see whether the "greening of Greenland," so regularly announced in the international press, is actually going to happen.

GREENLAND'S FIRST EXPERIENCE of hype happened a millennium ago when Erik the Red arrived from Iceland with a small party of Norsemen, aka Vikings. Erik was on the lam (from the Old Norse word *lemja*) for killing a man who had refused to return some borrowed bedsteads. In 982 he landed along a fjord near Qaqortoq, and then, despite the bedsteads incident, he returned to Iceland to spread word about the country he had found, which, according to the *Saga of Erik the Red*, "he called Greenland, as he said people would be attracted there if it had a favorable name."

Erik's bald-faced marketing worked. Some 4,000 Norse eventually settled in Greenland.

It feels as if Greenland is holding its breath—waiting to see if the "greening" will actually happen.

The Vikings, notwithstanding their reputation for ferocity, were essentially farmers who did a bit of pillaging, plundering, and New World discovering on the side. Along the sheltered fjords of southern and western Greenland, they raised sheep and some cattle, which is what farmers in Greenland do today along the very same fjords. They built churches and hundreds of farms; they traded sealskins and walrus ivory for timber and iron from Europe. Erik's son Leif set out from a farm about 35 miles northeast of Qaqortoq and discovered North America sometime around 1000. In Greenland the Norse settlements held on for more than four centuries. Then, abruptly, they vanished.

The demise of those tough, seafaring farmers offers an unsettling example of the threats climate change poses to even the most resourceful cultures. The Vikings settled Greenland during a period of exceptional warmth, the same warm period that saw expanded agriculture and the construction of great cathedrals in Europe. By 1300, though, Greenland became much colder, and living there became ever more challenging. The Inuit, who had arrived from northern Canada in the meantime, pushing south along the west coast of Greenland as the Vikings pushed north, fared much better. (Modern Greenlanders are mostly descended from them and from Danish missionaries and colonists who arrived in the 18th century.) The Inuit brought with them dogsleds, kayaks, and other essential tools for hunting and fishing in the Arctic. Some researchers have argued that the Norse settlers failed because they remained fatally attached to their old Scandinavian ways, relying heavily on imported farm animals instead of exploiting local resources.

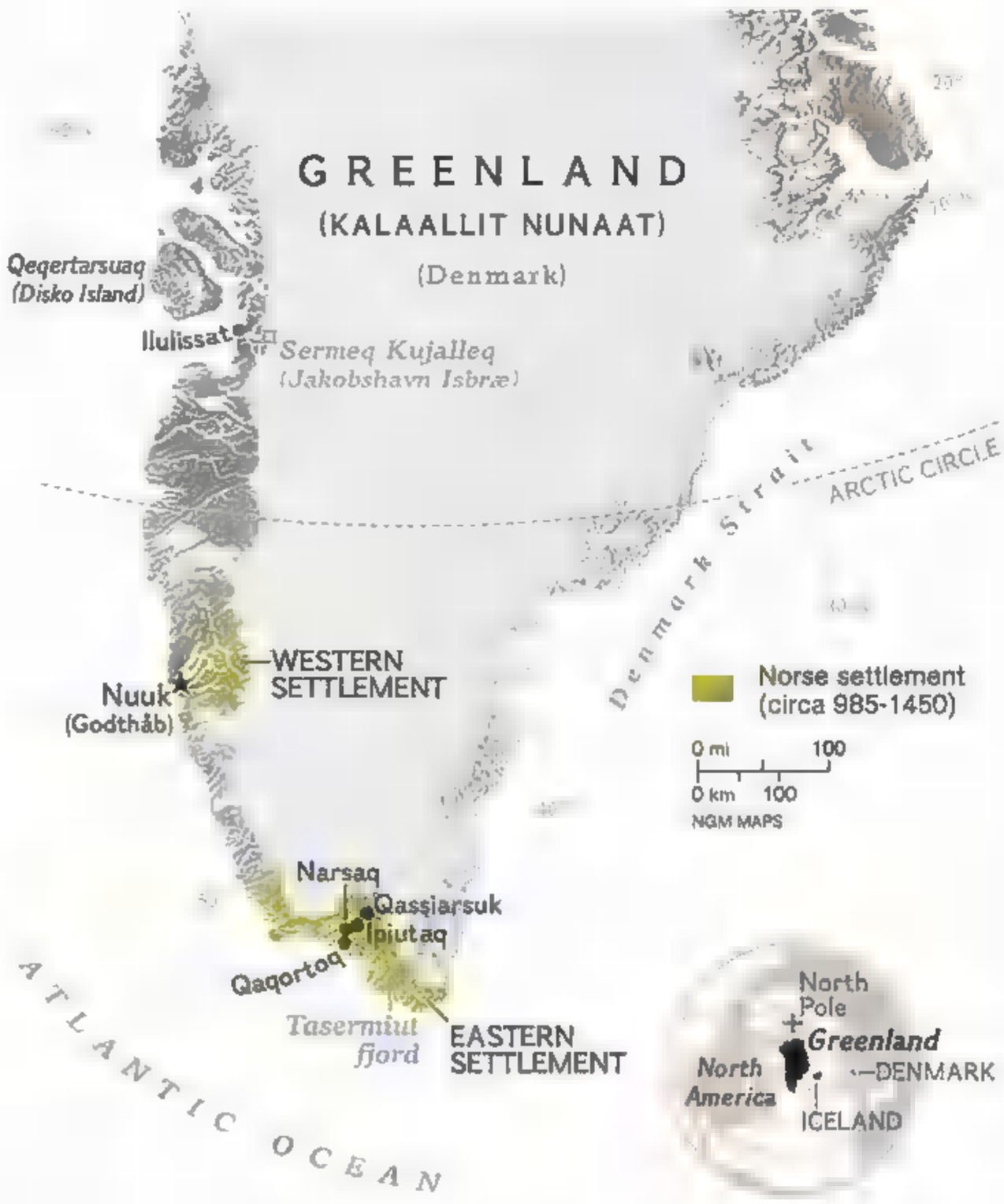
But more recent archaeological evidence suggests the Norse too were well adapted to their new home. Thomas McGovern, an anthropologist at Hunter College in Manhattan, says the Norse organized annual communal hunts for harbor seals, especially once the climate cooled and domestic livestock began to die. Unfortunately, harbor seals also succumbed. "Adult harbor seals can survive cold summers, but their pups can't," says McGovern. The Norse may have been forced to extend their hunts farther offshore in search of other seal species, in waters that were becoming more stormy.

"We now think the Norse had a very refined social system that required lots of community labor, but there was a major vulnerability—they had to have most of their adults out there trying to get the seals," says McGovern. "A trigger for the end of the Norse in Greenland could have been catastrophic loss of life from one bad storm." The Inuit would have been less vulnerable because they tended to hunt in small groups. "It's a much more complicated story than we

thought," McGovern says. "The old story was just, the silly Vikings come north, screw up, and die. But the new story actually is a bit scarier, because they look pretty well adapted, well organized, doing a lot of things right—and they die anyway."

The last historically documented event of Norse life in Greenland was not a perfect storm, though, nor a famine nor an exodus to Europe. It was a wedding held at a church near the head of Hvalsey fjord, about ten miles northeast of Qaqortoq. Much of the church still stands on a grassy slope beneath a towering granite peak.

On a cool morning last summer a strand of fog lingered high up on the peak's eastern face like a gossamer pennant. Wild thyme with delicate, purple-red flowers spread low across the ground in front of the 800-year-old church, now roofed only by sky. All four of the three-foot-thick, stone-slab walls remain intact—the eastern wall is about 18 feet tall. They were evidently built by people who intended to stay here a while. Within the walls, grass and sheep droppings cover the uneven ground where, on September 14, 1408, Thorstein Olafsson married Sigrid Bjørnsdottir. A letter sent from Greenland to Iceland in 1424 mentions the wedding, perhaps as part of an inheritance dispute, but provides no news of strife, disease, or any inkling of impending disaster. Nothing more was ever heard from the Norse settlements.



GREENLANDERS TODAY, all 56,000 of them, still live on the rocky fringes between ice and sea, most in a handful of towns along the west coast. Glaciers and a coastline deeply indented by fjords make it impossible to build roads between the towns; everyone travels by boat, helicopter, plane, or, in the winter, dogsled. More than a quarter of all Greenlanders, some 15,500, live in Nuuk, Greenland's capital, about 300 miles north of Qaqortoq as the narwhal swims.

Take one part quaint Greenlandic town, complete with fjord and exhilarating mountainous backdrop, mix with maybe four parts grim Soviet-bloc-style apartments, add two traffic lights, daily traffic jams, and a nine-hole golf course, and you've got Nuuk. The sprawling, rundown apartment blocks are a legacy of a forced modernization program from the 1950s and 1960s, when the Danish government moved people from small traditional communities into a few large towns. The intent was to improve access to schools and health care, reduce costs, and provide employees for processing plants in the cod-fishing industry, which boomed in the early 1960s but has since collapsed. Whatever benefits the policy brought, it bred a host of social problems—alcoholism, fractured families, suicide—that still plague Greenland.

But this morning, on the first day of summer 2009, the mood in Nuuk is jubilant: Greenland is celebrating the start of a new era. In November 2008 its citizens voted overwhelmingly for increased independence from Denmark, which has ruled Greenland in some form since 1721. The change is to become official this morning in a ceremony at Nuuk's harbor, the heart of the old colonial town. Queen Margrethe II of Denmark will formally acknowledge the new

Sheep are rounded up near Qassiarsuk, where Erik the Red raised cattle. Greenland spends nearly two million dollars a year subsidizing its 50 sheep farms, which import much of their fodder.

Haymaking time in Greenland evokes the sunny side of global warming, which just might allow Aviaja Lennert and her family to grow enough grass for their 700 sheep.

relationship between her country and Kalaallit Nunaat, as the locals call their homeland.

Per Rosing, a slender 58-year-old Inuit man with a gentle manner and a graying black ponytail, conducts the Greenland National Choir. "I'm just happy, totally happy," he says, putting a hand over his heart as we walk with ■ large crowd toward the harbor, down streets still wet from last night's freezing rain and snow. People are streaming out of Block P, Nuuk's biggest apartment building, which alone houses about one percent of Greenland's population. Its windowless, concrete end has become ■ frame for a defiantly optimistic work of art: a four-story-tall, white-and-red Greenlandic flag. A local artist sewed the flag with the help of schoolchildren from hundreds of articles of clothing.

By 7:30 people are packed shoulder to shoulder on the dock. Others perch on the roofs of old wooden homes around the harbor; a few watch from kayaks, paddling just enough to stay put in calm, metallic-looking water. The ceremony

charter to Josef Tuusi Motzfeldt, the speaker of Greenland's Parliament. The crowd cheers, and a cannon fires on a hill above the harbor, sending a pressure wave through us like a shared infusion of adrenaline.

UNDER THE NEW CHARTER, Denmark still manages Greenland's foreign policy; the annual subsidy continues as well. But Greenland now exerts greater control over its own domestic affairs—and in particular, over its vast mineral resources. Without them, there's no chance that Greenland could ever become economically independent. Right now fishing accounts for more than 80 percent of Greenland's export income; shrimp and halibut are the mainstays. While halibut stocks are holding steady, shrimp populations have dropped. Royal Greenland, the state-owned fishing company, is bleeding money.

The reasons for the decline of the shrimp—known here as "pink gold"—are unclear. Søren Rysgaard, director of the Greenland Climate Research Center in Nuuk, says that Greenland's climate, besides getting warmer, is becoming more unpredictable. Rising sea temperatures may have disrupted the timing between the hatching of shrimp larvae and the blooms of phytoplankton the larvae feed on; no one really knows. Fishermen hope cod will return as waters warm. But after a small uptick a few years ago, cod numbers have fallen again.

"The traditional way of life in Greenland was based on stability," says Rysgaard. Apart from southern Greenland, which has always been swept by Atlantic storms, the climate, although formidably cold, seldom surprised. The huge ice sheet, with its attendant mass of cold, dense air, enforced stability over most of the country. "In the winter you could hunt or fish with your sled dogs on the sea ice. In the summer you could hunt from a kayak. What's happening now is that the instability typical of southern Greenland is moving north."

Johannes Mathæussen, a 47-year-old Inuit halibut fisherman, has seen those changes firsthand. Mathæussen lives in Ilulissat (Greenlandic for "icebergs"), a town of 4,500 people and

begins with the choir singing Greenland's national anthem, "Nunarput Utoqqarsuanngoravit—You, Our Ancient Land." Rosing turns to the crowd and gestures for everyone to join in. As of today, Kalaallisut, an Inuit dialect, is the official Greenlandic language, supplanting Danish.

Then, shortly after eight o'clock, the Danish queen, wearing the traditional Inuit garb of a married woman—red, thigh-high, sealskin boots, or kamiks, a beaded shawl, and sealfur shorts—presents the new self-government

An Inuit boy from a foster home in Nuuk learns hunting from a mentor; here they've bagged a caribou. Most Greenlanders hunt, and fishing is by far the dominant industry. Workers at the city's Royal Greenland plant (below) package whole, frozen cod for export. High labor costs make it cheaper to ship the fish to China or Poland for processing.

almost that many sled dogs located 185 miles north of the Arctic Circle. On an overcast day in late June we set out from Ilulissat's harbor, motoring past a big shrimp trawler in Mathæussen's 15-foot-long open boat, a typical craft for halibut fishermen here. Summer fishing is still good for them, but winter is becoming a problem.

"Twenty years ago, in the winter, you could drive a car over the ice to Disko Island," Mathæussen says, pointing to a large island about 30 miles off the coast. "For 10 of the last 12 years, the bay has not frozen over in the winter." When the bay used to freeze, Mathæussen and other fishermen would rig their dogsleds and go ice fishing ten miles up the fjord. "I would spend a day and a night and bring back 200 or 500 pounds of halibut on my sled. Now winter fishing in the fjord is dangerous with a heavy load; the ice is too thin."

Mathæussen steers his boat through a broken canyon of ice that is drifting imperceptibly out to sea. The largest bergs rise 200 feet above us with keels scraping the bottom 600 feet down. Each one has its own topography of hills, cliffs, caves, and arroyos of smooth white flanks polished by meltwater streams. All this ice comes from Jakobshavn Isbræ, aka Sermeq Kujalleq, the "southern glacier," which drains 7 percent of Greenland's ice sheet and launches more icebergs than any other Northern Hemisphere glacier. (The iceberg that sank the *Titanic* probably calved here.) In the past decade Sermeq Kujalleq has retreated almost ten miles up the fjord. It is Greenland's biggest tourist draw—19,375 people came to see global warming in action here in 2008. Tourism remains a distant second to fishing, though; the season is short, accommodations are limited, and travel is expensive.

THE FOUNDATION of Greenland's future economy lies out beyond Disko Island, just over the horizon from Mathæussen's spectacular fishing ground: That's where the oil is. The sea off the central west coast now typically remains ice free for nearly half the year, a month longer than 25 years ago. With the greater ease of working in Greenland's waters, ExxonMobil, Chevron, and other oil companies have acquired exploration licenses. Cairn Energy, a Scottish company, plans to drill its first exploration wells this year.

"We've issued 13 licenses covering 130,000 square kilometers off the west coast, roughly three times the size of mainland Denmark," says Jørn Skov Nielsen, director of Greenland's Bureau of Minerals and Petroleum. We're at a bustling trade convention in a conference center in Nuuk on a rainy Saturday afternoon. The smell of oil wafts from a rock sample—a chunk of basalt the size and shape of half a bowling ball—that is displayed on a nearby table. "Production could be possible in ten years if we're lucky," Nielsen says. "We have some very impressive estimates for northwest and northeast Greenland—50 billion barrels of oil and gas." With oil prices now topping $80 a barrel, those reserves would be worth more than four trillion dollars, a windfall that could fund the country's independence.

To some Greenlanders it would be a Faustian bargain. Sofie Petersen, the Lutheran bishop, has an office overlooking the harbor in one of Nuuk's few surviving old wooden homes. Just up the hill stands a statue of Hans Egede, a quixotic Lutheran missionary who came here in 1721 looking for survivors of the lost Norse settlements. He found no Norsemen but founded Nuuk, or Godthåb, as the Danes called it, and set in motion the Danish colonization of Greenland and its conversion to Christianity. Like nearly all Greenlanders, Petersen has a Danish surname, but she is Inuit.

Greenland's future may lie out beyond its spectacular fishing grounds: That's where the oil is.

"I think oil will damage our way of living," she says. "Of course everyone needs money, but should we sell our souls? What will happen if we are millionaires, every one of us, and we can't deliver Greenland as we know it to our grandchildren? I

On a cool day in August, descendants of local farmers harvest potatoes along a fjord the Vikings settled [illegible] Greenland [illegible]

would rather have little money and give the land to our grandchildren instead."

"It's a big dilemma to deal with the oil issue, since the Arctic people are the ones most exposed to climate change," says Kuupik Kleist, Greenland's popular new prime minister. Sometimes called Greenland's Leonard Cohen—he has recorded a few CDs—Kleist is a broadly built, owlish man of 52 with a husky, sonorous voice. The irony in his country becoming a major producer of the very stuff that is helping to melt its ice sheet is not lost on him.

"We need a stronger economy," Kleist says, "and we have to utilize the opportunities that oil could bring to us. Environmentalists around the world advise us not to exploit the oil reserves. But we are not in the situation where we can replace the declining income from our fisheries, and we don't have any other resources for the time being that hold as much potential as oil."

Actually there is one other resource with enormous potential, but it is equally fraught. Greenland Minerals and Energy Ltd., an Australian company, has discovered what may be the world's largest deposit of rare earth metals on a plateau above the town of Narsaq in southern Greenland. The rare earths are crucial in a wide variety of green technologies—hybrid-car batteries, wind turbines, and compact fluorescent lightbulbs—and China now controls more than 95 percent of the world's supply.

I ask the farmer if global warming will make life easier. "Last year we almost had a catastrophe," he says.

The development of the deposit at Narsaq would fundamentally shift global markets and transform Greenland's economy. John Mair, general manager of Greenland Minerals and Energy, says that Narsaq's reserves could sustain a large-scale mining operation for well over 50 years, employing hundreds in a town that has been devastated by the collapse of cod fishing. His company has dozens of employees prospecting the site right now. But there is a major obstacle to developing it: The ore is also laced with uranium, and Greenland's government has a complete ban on uranium mining. "We haven't changed those regulations and are not planning to," Kleist says. There is no easy path, it seems, to a greener Greenland, in any sense of the word.

GREENLANDERS JOKINGLY call the area around Narsaq and Qaqortoq, Sineriak Banaaneqarfik, the Banana Coast. Today the grandchildren of Inuit hunters till fields there, along fjords where Vikings once farmed. If Greenland is greening anywhere, it is here. But as soon as I arrive, the agronomist Kenneth Høegh cautions me to forget what I've read about Greenland's sudden cornucopia. "Arctic Harvest," read one headline; "In Greenland, Potatoes Thrive," read another. Potatoes do grow in Greenland these days. But not so very many just yet.

On a gorgeous July morning Høegh and I are cruising at about 25 knots up the fjord settled by Erik the Red a millennium ago. Our destination is Ipiutaq, population three. Kalista Poulsen is waiting for us on a rocky outcrop below his farm on the northern shore of the fjord. Even in faded gray overalls, Poulsen looks more like a scholar than a farmer: He's slender, wears glasses, and speaks English with what sounds, strangely enough, like a French accent. His great-great-grandfather was an *angakkoq*—a shaman—one of the last in Greenland, who had killed men in feuds before converting to Christianity after having a vision of Jesus.

We walk through Poulsen's lush fields of timothy and ryegrass. Compared with the fjord's sheer gray walls, the fodder crops look almost fluorescent. In September Poulsen will acquire his first sheep, which is what nearly all of Greenland's farmers raise, mostly for meat. He bought the farm in 2005, as the outside world was first hearing talk of a gentler, warmer Greenland.

From where Poulsen stands, the promise seems remote. "This is my war zone," he says, as we trudge across muddy, boulder-strewn ground that he's clearing for cultivation with a backhoe

Rain blurs the view of icebergs in Narsaq, where a mysterious decline in shrimp has shuttered a processing plant and left dozens of residents pondering an uncertain future.

and a tractor with big tillers he had delivered on old military landing craft. When I ask Poulsen if he thinks global warming will make life easier for him or his child, his expression becomes almost pained. He looks at me appraisingly as he lights a cigarette, which momentarily disperses a cloud of mosquitoes.

"Last year we almost had a catastrophe," he says. "It was so dry the harvest was only half of normal. I don't think we can count on normal weather. If it's getting warmer, we'll have to water more, invest in a watering system. In the winter we don't have normal snow; it rains, and then it freezes. That's not good for the grass. It's just exposed in the cold."

Over lunch in Poulsen's white wood-frame home, the mystery of his French accent is solved: Agathe Devisme, his companion, is French. Savoring the fusion meal she has prepared—shrimp and catfish au gratin, *mattak*, or raw whale skin, and apple cake flavored with wild angelica—I think back to the more rustic dinner I'd enjoyed a few nights earlier in Qaqortoq, at an annual gala attended by nearly every farming family on the Banana Coast. After dinner a white-haired Inuit man had begun playing an accordion, and everyone in the hall, some 450 people, had linked arms, swaying side to side as they sang a traditional Greenlandic paean:

Summer, summer, how wonderful
How incredibly good.
The frost is gone,
The frost is gone…

Leaving the Poulsens, Høegh and I run back down the fjord with the *føn*—the wind off the ice sheet—at our stern. Høegh would be happy, he had said earlier, if Greenland's farms were to get to the point where they grow most of their own winter fodder for their sheep and cattle; many farms, far from feeding their countrymen, now import more than half their fodder from Europe. In Høegh's house that evening we stand looking out the window at his garden. The føn has become fierce. Horizontal sheets of rain flatten his rhubarb and his turnips; his trees bend like supplicants before implacable old gods. "Damn!" Høegh says quietly. "The weather's tough here. It will always be tough." □

COUNTING

CRANES

HOW MANY WILD WHOOPING CRANES ARE THERE? NOT ENOUGH.

An adult *Grus americana* makes a splashing run-up to flight through a marsh in Canada's Wood Buffalo National Park.


Bowing to its hatchling's
offers an insect morse
another egg should na
though usually only one chick will survive the
season Parents take turns tending the nest

BY JENNIFER S. HOLLAND
PHOTOGRAPHS BY KLAUS NIGGE

Nearly grazing the treetops, a tiny red plane swoops in dizzying circles over the bogs and forests of Canada's Wood Buffalo National Park.

As pilot Jim Bredy banks hard for another pass, he and his two passengers press their faces against the glass, squinting to spot familiar white smudges on the ground—adult whooping cranes—with russet-feathered young in tow. This wilderness is the summer home of the last wild migratory flock of Earth's most endangered crane.

The aerial census takers are Bredy, Tom Stehn of the U.S. Fish and Wildlife Service, and Lea Craig-Moore of the Canadian Wildlife Service (CWS), and they're worried. The flock's population had reached 266 in the spring of 2008. But by the following spring, 57 had died, 23 of them on the birds' wintering grounds in south Texas, where drought had decimated their main food—blue crabs and a plant called wolfberry. Others probably perished during migration, often after striking power lines, the biggest known killer along the flyway. The higher-than-average death count has added urgency to a new effort that tracks some migrating birds with GPS anklets.

Jennifer S. Holland is a senior staff writer. Klaus Nigge photographed the endangered Philippine eagle for the February 2008 issue of the magazine.

Still, whoopers, as they're called, aren't nearly as bad off as they once were. A key event in their revival took place 42 years ago, when CWS biologist Ernie Kuyt went on a spring treasure hunt. A helicopter let him off on the soggy boreal landscape, a vast expanse of sedge meadow and ponds broken up by islands of black spruce and willow. Using a jack pine pole as a staff, he trudged through muck that might have stolen his resolve—and his boots. At the heart of a shallow pool, he spied a massive nest cradling a pair of blotchy eggs, each the size of an Idaho potato. Kuyt had left his container in the copter, so he tucked a sole egg into a wool sock, sensitive to the weight of the future life—and the possible salvation of a species—he'd carry home.

Kuyt's excursion marked a major step in the now decades-long effort to save the whooping crane, begun by the National Audubon Society's Robert Porter Allen and others in the 1940s. The egg in Kuyt's sock helped seed the captive-breeding program that is crucial to the species' rescue. Multiple flocks once crisscrossed the continent, but numbers fell drastically in the mid-1800s as settlers converted wetlands to

Months-old siblings, which will be mainly white by their second fall, cross paths in winter in Aransas National Wildlife Refuge, Texas.

farms and shot birds for meat. When a major storm in 1940 led to the petering out of a flock in Louisiana, at most 22 wild whoopers remained.

The bird has become the emblematic endangered species, thanks in part to its fierce charisma. Standing nearly five feet tall, it can spy a wolf—or a biologist—lurking in the reeds. It dances with springing leaps and flaps of its mighty wings to win a mate. Beak to the sky, it fills the air with whooping cries. The sole wild flock, listed under the Endangered Species Preservation Act in 1967, has slowly expanded. At the same time, conservationists have hatched and bred the birds in captivity and reintroduced them to their former habitat, boosting the total—including captive stock—to more than 500.

> "With enough habitat protection," says biologist Brian Johns, "in a couple of decades maybe the population won't need us anymore."

To rescue this darling among the world's 15 crane species, scientists first needed to answer a burning question: Where did whoopers nest—and lay eggs—in summer? Since the late 1890s biologists had known that the wild flock wintered on coastal marshland in what would later become the Aransas National Wildlife Refuge in Texas. To crack the summer mystery, officials asked citizens to report sightings; volunteers combed the migration route for clues. Then, in the summer of 1954, a report came from a fire helicopter flying over a virtually inaccessible wetland some 2,500 miles north of Texas, on northern Canada's boreal plains. A whooper family was on the ground. By lucky chance, the flock had settled inside Wood Buffalo, the biggest national park in North America.

The remoteness of the 17,298-square-mile wilderness, set aside in 1922 for Canada's last wood bison, has aided the cranes. Here whoopers face only natural predators—wolves, bears, foxes, egg-stealing ravens—as they guard two-square-mile territories, nest hock-deep in water, and raise one or sometimes two chicks on a diet including insect larvae, seeds, snails, and fish. "Wood Buffalo is and always will be truly wild," says Tom Stehn. "The birds are safe here."

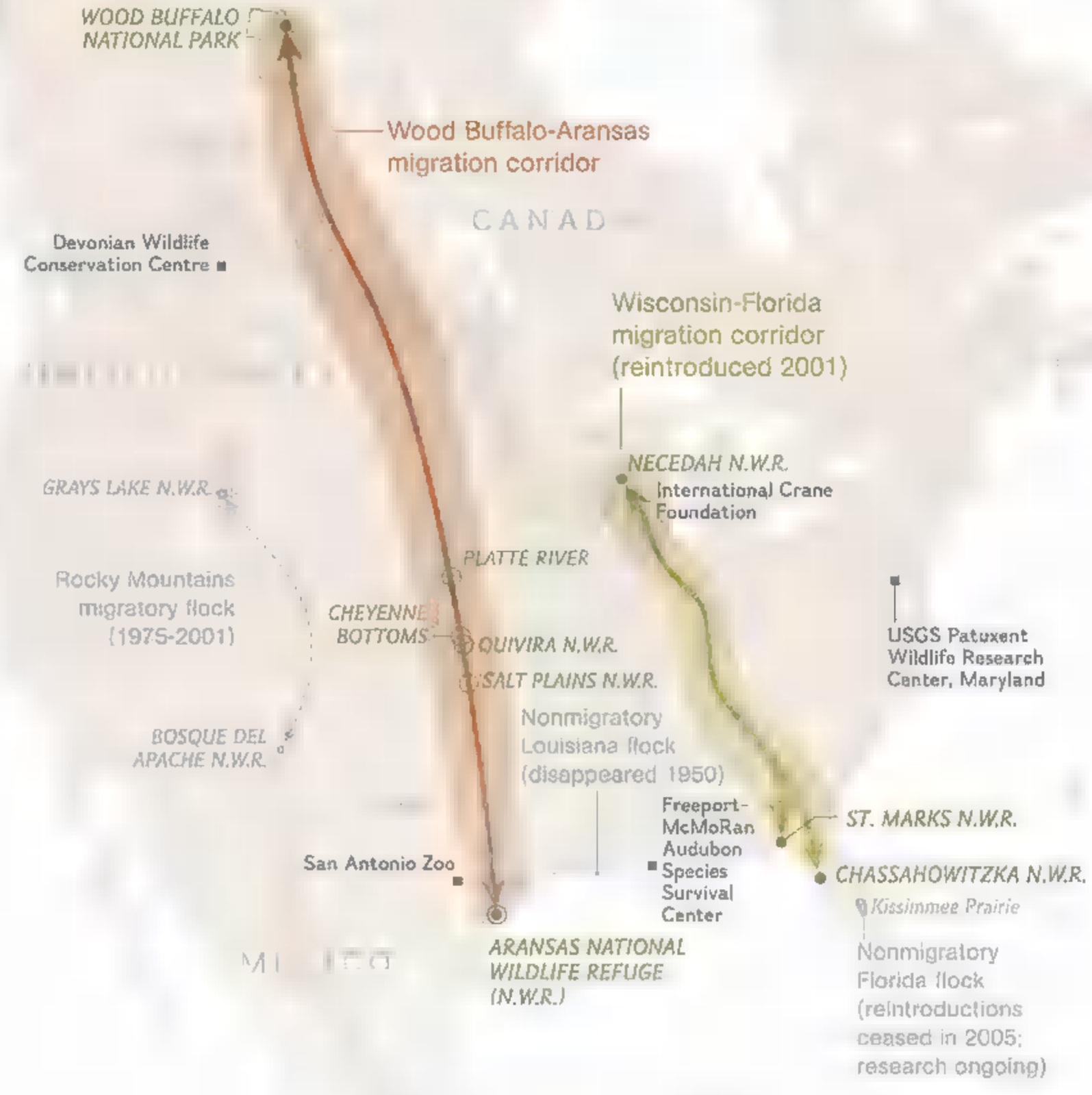
Back overhead, the red plane dips to the west as Craig-Moore excitedly calls out another sighting. Even with GPS coordinates from past surveys, it will take multiple flights over several months—59 hours in the air—to finish one season's count of 62 nests, 52 chicks, and 22 fledglings spread over 100 square miles.

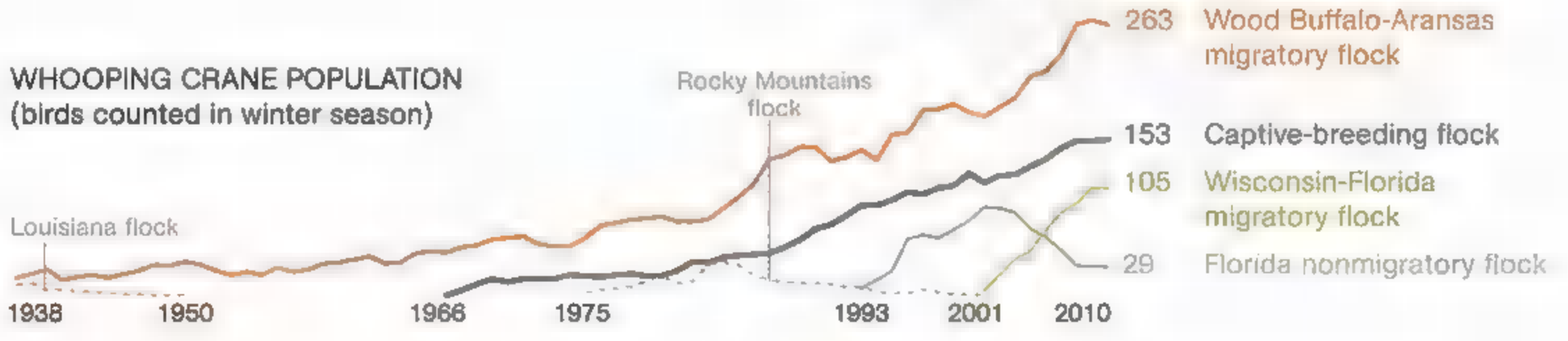
As of February 2010, the cranes' annual tally sat at 263. So they are holding steady—but remain at great risk. In Texas, water diversion for farms and suburbs is boosting salinity in coastal salt marshes, killing the crabs that cranes eat in winter. That land is already vulnerable to storms and rising seas. Lost wetlands, oil sands development in Alberta, and wind power projects also mean fewer resting spots on the flyway. "The best wind flows along the migration route," says Stehn, "and there are plans to erect thousands of turbines." Windmills themselves may not present major obstacles, but power lines will. "It shows how fragile a success story this is."

Today's population must expand at least fivefold before bird advocates can truly rest. But veterans of the effort are optimistic about reaching that goal. Says CWS biologist Brian Johns, "With enough habitat protection, in a couple of decades maybe the population won't need us anymore. Maybe we can finally leave the cranes alone."

Come October, the cranes at Wood Buffalo prepare for an ancient ritual, the weeks-long journey to their Texas wintering grounds. Strutting across the spongy earth, an adult male tilts his head, one yellow eye peering skyward, waiting for his weather cue: The arrival of thermals that will carry his family aloft. As the air begins to shimmer, he leans his long body forward, signaling his intention. His mate and young quickly copy the posture. And then, in near-perfect unison, they take off. □

Whooper Whereabouts
In 1966 biologists set up a crane captive-breeding program at Patuxent. In a controversial step they took eggs from wild nests to seed the flock. Five sites now propagate whoopers. Reintroductions failed in Idaho; hope lies elsewhere. One captive-bred eastern flock is being trained to migrate behind ultralight planes.





In a maneuver rarely seen and never before photographed, a raven snatches a chick by the leg after pecking into the egg. Though human access to crane habitat in Wood Buffalo is restricted, predators like birds, wolves, and bears can rob the flock. Adult whoopers are ever vigilant, watching from the tall reeds.

MAP: VIRGINIA W. MASON, NGM STAFF; CAITLIN SARGENT
SOURCES: U.S. FISH AND WILDLIFE SERVICE; INTERNATIONAL CRANE FOUNDATION

Size trumps numbers as a crane scatters black-bellied whistling-ducks near a game feeder on a private Texas ranch. The conservation-minded owners have legally protected this land to shelter their annual visitors.

Youngsters grown up enough to migrate 2,500 miles to Texas still beg for crabs and clams from an adult probing brackish water at Aransas. Nearly ■ century into conservation efforts, including long-term monitoring of banded birds (right), whoopers have taken a big step back from the edge. But only with healthy habitat across their range can the wild flock persevere. Says biologist Tom Stehn, "There's just no wiggle room with this species."

South Africa is a vibrant, multiethnic democracy striving, with mixed success, to fulfill its promise. Photojournalist JAMES NACHTWEY *offers a vision of contemporary life, and* ALEXANDRA FULLER *tells an intimate story about the long shadow of apartheid.*

MANDELA'S CHILDREN

At Eden Park near Johannesburg, the moon rises over government-built houses that reflect South Africa's drive to become the just society Nelson Mandela envisioned when he won the Nobel Peace Prize in 1993. It will be measured by the happiness and welfare of the children.

TIED TO TRADITION Xhosa teens, initiated into manhood in ■ centuries-old circumcision ritual called *ulwaluko*, stay in seclusion outside their Eastern Cape village, wrapped in ceremonial blankets and painted with white clay for purification. Hospital surgeries reduce the infection rate, but many boys opt for the old rite.

SLOW TO CHANGE Four generations on, and the rhythm of life continues much as ever for Afrikaner Bertie Swanepoel, who raises cattle and sheep on his 3,000-acre ranch in the Free State. Whites still own more than 80 percent of commercial farmland; reform efforts have delivered only a sliver of land to blacks.

PROMISES TO KEEP A girl in Soweto's struggling Kliptown neighborhood accepts an apple from ■ local woman. Many Kliptown residents lack electricity and have to collect water in buckets. President Jacob Zuma, smiling in ■ 2009 election campaign poster behind the child, has vowed to provide basic services.

SOCCER CITY Johannesburg's new 94,000-seat stadium, inspired by the shape of a traditional African pot, sparkles against the city's skyline. With all eyes on the World Cup host, South Africa aims to dazzle: President Zuma calls 2010 the most critical year since 1994, when apartheid ended.

A DAY OF RECKONING

THE MINISTER

It turns out there is no shortcut, bolt-of-inspiration way to transform a person from layman to minister in the Dutch Reformed Church of South Africa. It takes seven years of rigorous training—seven years of Deon Snyman's youth—which made it all the more distressing when, toward the end of his studies at the University of Pretoria in 1990, Snyman realized he had all the theology a person could possibly need to function in the old South Africa but almost no skills to guide him in the country that had just released Nelson Mandela.

Snyman, who was born and raised in "a traditional Afrikaans family, in a typical Afrikaans town north of Johannesburg," says that back then he knew no black people, had no black friends, had never even had a meaningful conversation with a black person. "The church was divided into white congregations, Coloured congregations, Indian congregations, and black congregations," he says. He decided that the best way he could avoid waking up one morning a foreigner in his own country was to become the minister of a rural, black congregation.

On the day in February 1992 that Deon Snyman was installed as a minister in the Dutch Reformed Church in Africa—the church's black branch—in Nongoma, in the heart of the Kwa-Zulu homeland, his 54-year-old father stood up in front of the congregation, all of whom were Zulus, and said this: "Well, it is clear that South Africa is going to change. But I am an Afrikaner. I do not know if I have the capacity to change. Also, I am an old man. I do not know if I have the skills to change." Then the father indicated his 26-year-old son. "So today, I give you my son. If you can teach him the rules of the new South Africa, he can teach us those rules. If you can give him the skills to live in this new country, he can show us those skills."

In the dozen years Snyman lived among the Zulus as a minister, it became clear that the lesson he had to take back to his own people was this: "Those who supported the system of apartheid need to apologize in a way that will feel sincere. Then they need to make amends in a way that restores some of the dignity and some of the material opportunities that had been eroded under that system." Snyman started to think about the idea of community-led restitution—the creation, he says, of such emblems of remorse as a school, a clinic, or a skills training center. "Something everyone could point to and say, Here is our symbol of true sorryness, here

is a symbol of our decision to build a new way to work together. It was a very deep idea in me."

But it would be years before Snyman's imagination was captured by a small Afrikaans farming town in the Western Cape, a community unable to deny that the effects of apartheid had spilled on beyond 1994, when white rule ended and Nelson Mandela became the reborn nation's first president.

THE TOWN

Worcester is a somnolent, gingerbread town prickled with white church spires an hour and a half northeast of Cape Town. In winter, the surrounding mountains are snowcapped. In summer, heat holds like hell's breath in the valley and melts the tarmac. The streets are wide and orderly. The houses are gabled and picturesque; lawns are cajoled into neat pockets; there are steroidal roses and trellises hanging grapevines off verandas. It's the sort of town that makes you wish you'd worn a longer skirt and a higher collar.

In the mid-1990s the lines drawn deep in the geography and psyche of the place by apartheid were still evident, but no more so than elsewhere in the country. It is true that blacks still lived mainly in Zwelethemba township—Worcester's undernourished twin across the Hex River—while whites still lived on the dappled streets of the town itself or on farms laid at the feet of the mountains. On the other hand, Worcester had elected its first Coloured (mixed race) mayor and its first black deputy mayor. Also, in June 1996 the Truth and Reconciliation Commission (TRC)—a courtlike body assembled after the abolition of apartheid—had held a hearing in the town. Victims and perpetrators of torture and abuse under apartheid had stepped forward and testified. The violent past was over, surely.

So it came as a shock when, on a sweltering Christmas Eve afternoon in 1996, two bombs ripped through a shopping area just down the street from the police station and the Dutch Reformed Church. The blasts killed four people—three of them children. Nearly 70 people were injured. All the victims were blacks and Coloureds. The first bomb to go off, around 1:20, hit Olga Macingwane in such a way that her legs swelled instantly to the size of tractor tires. Minutes later, the second bomb went off, and she was blown unconscious.

"For 13 years I never saw the person who did this to me," Macingwane says, speaking from her sitting room in Zwelethemba on a very warm Sunday morning in late November 2009. Macingwane is a profoundly proper woman of a certain age. She is wearing a pink, ankle-length pencil skirt and matching jacket. Outside her home the township is in the midst of open-air church services, and Macingwane has to raise her voice to be heard. She gets up stiffly—it is obviously painful for her to walk—and closes the door to the yard and to the world at large. The singing reaches into her home unabated. "In my head," she continues, as the choirs of at least three churches compete on the torrid air, "I pictured him. In my head he is a man of 50 years old, very big, with a long beard and a very severe face. That is the man who did this thing. That is the person I see in my nightmares."

A TURNING POINT

South Africa's selection to host the 2010 World Cup gave people a surge of confidence. Their nation could now be remembered for bringing the world soccer rather than apartheid. South Africa's modern infrastructure, enviably chic airports, cosmopolitan restaurants—its public face—all support the suggestion that its tragic history is just that, history. Much of Soweto, Johannesburg's infamous township in which apartheid-era violence visible to the foreign media occurred, is now a series of bucolic suburbs: Florida-lite architecture behind smooth lawns, sleek foreign cars in driveways. (Squatter camps encroaching, it is true.) South Africa has a burgeoning black middle class, and since 1994 the government has built almost three million houses. In Johannesburg, just across the road from a casino and an amusement park, tourists can visit the impressive Apartheid Museum.

But scratch the surface of any community, and one way or another there it is, the A-word.

Alexandra Fuller's first book was about growing up in Rhodesia during its violent transition to Zimbabwe. James Nachtwey photographed the end of South Africa's apartheid era for the February 1993 issue.

HOW DID HE
LEARN TO HATE
BLACK PEOPLE?
HOW DID HE

UNLEARN THIS HATRED?

AND IF HE IS
SO SORRY,
WHAT CAN HE
GIVE THEM?
THIS GOES ON
FOR TWO HOURS.

In May 2008 more than 60 people were killed and tens of thousands displaced in xenophobic riots targeting mainly Mozambicans and Zimbabweans. Apartheid ensured a deep mistrust of "other" and a sense of resource entitlement—based as much, if not more, on who you were as on what you did—that carries over to this day.

It is impossible to overestimate the reach and brutality of apartheid. Between 1948 and 1994, when the system was dismantled, the Afrikaans National Party applied hyper-segregation of races to every possible facet of life. "Apartheid so effectively enriched a few at the utter debasement of the majority—to say nothing of the imprisonment of so many, the exile, the disappearances, the violent deaths—that a mere end to the system could not begin to repair the damage," Tshepo Madlingozi says. Madlingozi is a 31-year-old senior lecturer of law at the University of Pretoria and an advocacy coordinator for the Khulumani Support Group, an organization of 58,000 victims of political violence, mainly during the apartheid era. "You can say, Everybody is equal now; let's get on with it. That suits those who benefited from the system—but it does nothing to institute restorative justice, and it can't undo generations of habitual racism, palpable hate, or feelings of inadequacy."

THE PRISONER

Less than a month after the Worcester bombing, 19-year-old Daniel Stephanus "Stefaans" Coetzee phoned the police from his hideout on a farm in the heart of the Great Karoo highlands—a sparsely populated, semiarid region in the central west of the country—and claimed responsibility for his part in the atrocity. Coetzee addressed the police officer in charge with respectful deference: *"Oom,"* he called him. "Uncle." He said he had heard that there were children among the dead, and for that reason he had no choice but to turn himself in. The boy had reserved country manners and a country person's way of keeping himself contained, catlike.

At the time he was taken into custody, and for some years after, Coetzee was a member of nearly every extreme right-wing, white supremacist group in South Africa, including one or two so secret and obscure that not even the people in them seem capable of explaining exactly what they are: Wit Wolwe, Israel Visie, Boere Aanvals Troepe. From prison Coetzee continued to communicate with members of the Ku Klux Klan in the United States and neo-Nazi groups in Germany, encouraging them in their endeavors. He rose up the ranks of the national groups' pseudo-military structures. As white supremacists go, Coetzee was a poster boy. In the pecking order of the Helderstroom Maximum Security Prison in Western Cape Province, however, he was pond life. "I was 19 years old and white. Everyone wanted to rape me," Coetzee says of those first years in overcrowded general cells holding between 60 and 120 men. "I couldn't get a bottom bunk. I couldn't even get a top bunk. I couldn't get any bunk at all." Coetzee slept on the floor.

When I meet him in Pretoria Central Prison in November 2009, where he has been held for over ■ decade, Coetzee has just turned 32. Having not felt the sun for so long, his skin has leached gray, and although he is strikingly young looking, there is a cluster of fine lines around his eyes such as are usually seen only on a much

older man. His hair is dark, very short, and downy. The leather belt he uses to hold up his prison-issue orange overalls is pulled to its last hole. It is not a surprise to learn that before his incarceration he was able to run far and fast in blistering heat with very little fuel or water. "I loved to run," he says, as if the words might set his legs free again. "*Ja,* I could run."

Coetzee and I sit facing each other, knee to knee, in a large, nondescript, yellow room designed for prison visits. Five or six windows along one wall let in a sluggish light that does nothing to enhance the greenish glow from the fluorescents. It is late morning and raining hard, and has been since early last night. As a result, it is cold, and we're both shivering.

Coetzee tells me he was born in 1977 to a careless mother and a drunken father. He has no memory of his parents being together. At first he lived with his father in the Orange Free State (now the Free State). When he was eight or nine his father burned out. After spending time in an orphanage, Coetzee was sent to live with his mother in Upington in the Northern Cape. For the next six or seven years Coetzee fell through one crack after another and was in and out of welfare homes, until at the age of 15 or 16 he was taken under the wing of a man named Johannes van der Westhuizen. A leader in the ultraright-wing, white supremacist cult Israel Visie, van der Westhuizen was a strict vegetarian, took no drugs, drank no alcohol, and studied a Bible that had been rewritten to bolster the idea that anyone who was not white was an animal of the field. In Coetzee's eyes, van der Westhuizen was roughly the size and age of a father.

If you were to walk more or less 300 miles northeast of Cape Town until the night sky grew so black you could see all the way back to whatever might be the beginning of time, the odds are good that you would be in the Great Karoo highlands. In the early 1800s this is where outlaws, cattle rustlers, and gunrunners hid, in the vast plains below the bruised Nuweveld Range. Even today so few people are tough or crazy enough to coax a living from this flinty, pepper-scented earth that it's considered a perfect destination for stargazers—and those who do not wish the modern world to find them. Its remote secretiveness appealed to van der Westhuizen, a man in deep denial about the reality of post-transition South Africa, and it was on his leased farm in this redoubt that the bombing was planned.

"When I was first in prison, I asked for a Bible," Coetzee says, explaining how he began to dismantle the hatred that had landed him on the floor of a crowded cell in a maximum-security prison. "But the Bible they gave me was not the same Bible I studied when I was with van der Westhuizen. I realized that the Bible I had been reading with him was skewed. That was the first thing." Then Coetzee was transferred to Pretoria Central Prison, where he took classes on anger management and restorative justice. He wrote a letter to the prison authorities asking if they would allow him to apologize to the people and the families he had hurt. (They advised against it.) But although he felt remorse for what he had done, Coetzee was still a racist.

In early 2002, five years after his arrest, he was assigned to a work detail with an older prisoner, Eugene de Kock. Now in his early 60s, de Kock is serving two life sentences plus 212 years for crimes against humanity committed while he was a colonel heading the notorious secret security unit of the South African Police. (His men dubbed him "prime evil," a name adopted by the media.) For hours at a time the two men would be together mopping floors. "Eugene was always telling me, 'Look Stefaans, you have to stop believing you are superior just because of the color of your skin,'" Coetzee says. "He said, 'Take it from me, I've learned the hard way.' I told Eugene, 'Please stop pestering me.' But he never shut up about it. He told me that until I stopped being a racist I'd be in two prisons—one around my body, and another one around my heart."

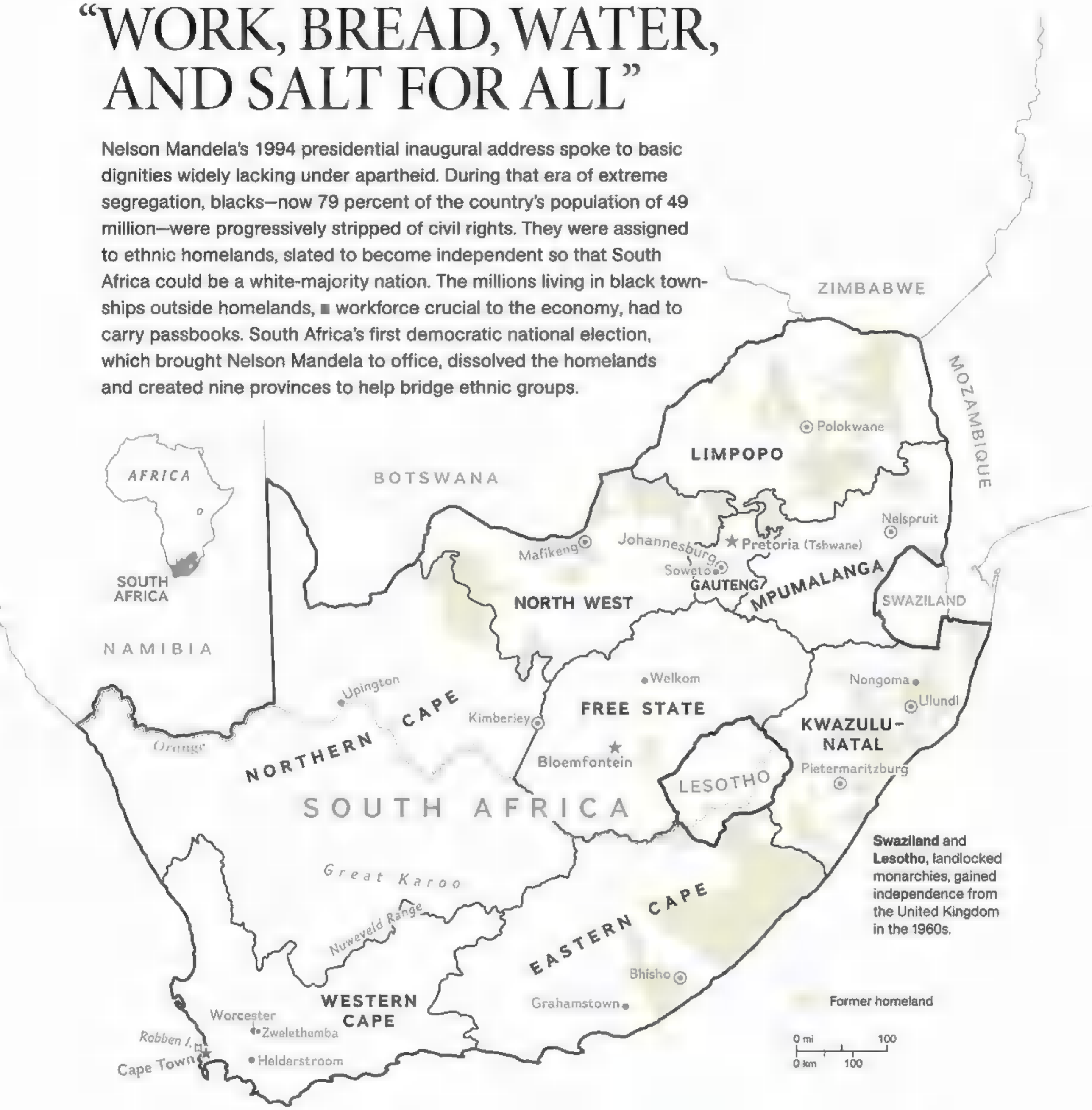
THE CONVERSATION

It is true that if every child from a difficult home in South Africa were to grow up and perform an act of brutality, there would be nothing and no one left in the country. As it is, there are 50 murders every day, and 140 reported rapes, although the actual number is believed to be in the hundreds. "Yes, the habit of violence is very deep in this culture," Marjorie Jobson, national director of the Khulumani Support Group, says. "You have to remember, the children who grew up in the atmosphere of apartheid—with all the lessons of that era—those children are now adults."

I have caught a lift *(Continued on page 104)*

"WORK, BREAD, WATER, AND SALT FOR ALL"

Nelson Mandela's 1994 presidential inaugural address spoke to basic dignities widely lacking under apartheid. During that era of extreme segregation, blacks—now 79 percent of the country's population of 49 million—were progressively stripped of civil rights. They were assigned to ethnic homelands, slated to become independent so that South Africa could be a white-majority nation. The millions living in black townships outside homelands, ■ workforce crucial to the economy, had to carry passbooks. South Africa's first democratic national election, which brought Nelson Mandela to office, dissolved the homelands and created nine provinces to help bridge ethnic groups.

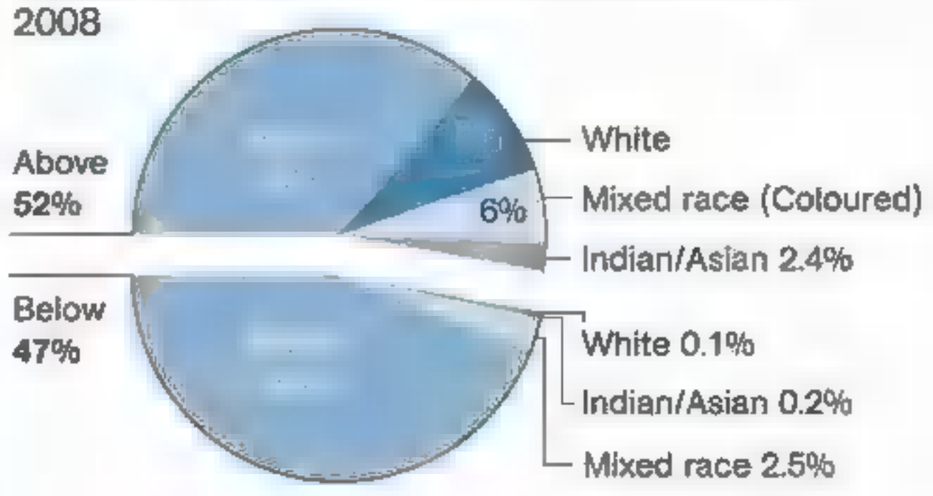


Swaziland and **Lesotho**, landlocked monarchies, gained independence from the United Kingdom in the 1960s.

DISMANTLING APARTHEID

Government programs to counter historic inequities between whites and nonwhites have met both success and frustration (graphics). South Africa has the continent's highest GDP, and its postapartheid economy overall has grown, in part because international investors no longer shun the country as a pariah. But the society remains strikingly two tiered: Few nations have a greater disparity between the incomes of their richest and their poorest.

Population above and below the poverty line*
2008

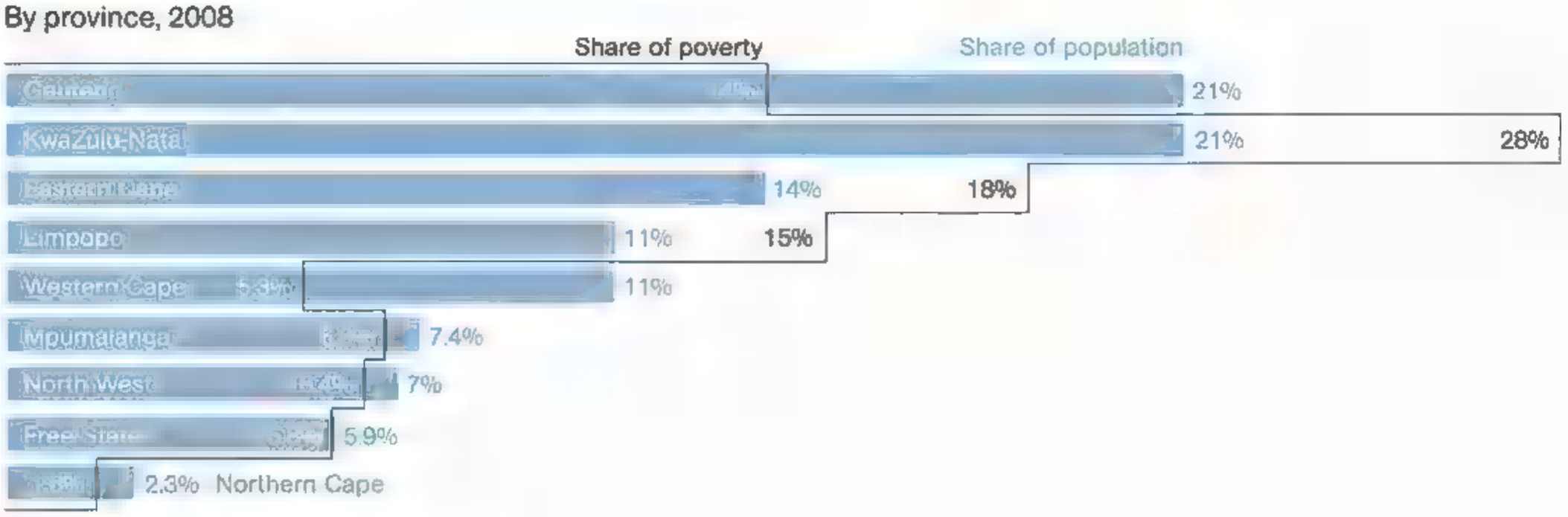


*502 RAND ($63) PER PERSON PER MONTH.
PERCENTAGES DO NOT EQUAL 100 BECAUSE OF ROUNDING.

LEGACIES OF INEQUALITY

Provinces with the largest portions of former homelands, which were mainly rural and underdeveloped, have the highest share of poverty.

Share of poverty and population
By province, 2008

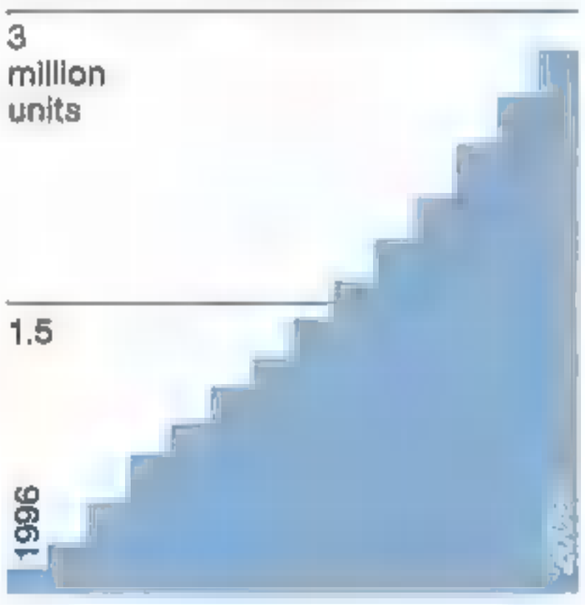


PERCENTAGES DO NOT EQUAL 100 BECAUSE OF ROUNDING.

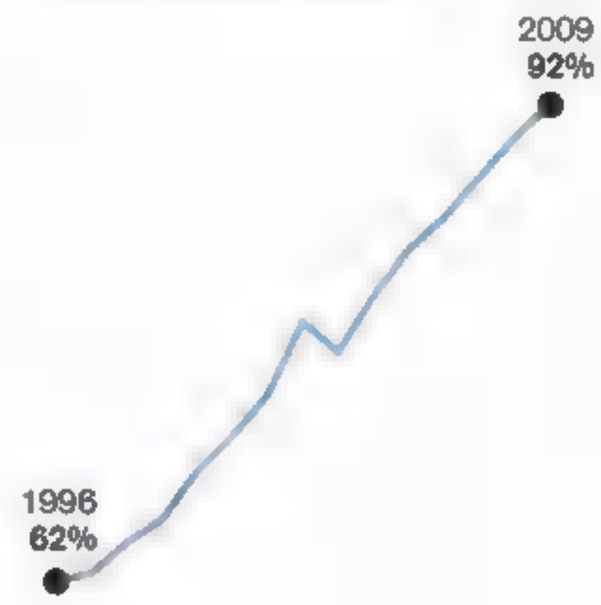
PROGRESS IN AN UPHILL CLIMB

Among the achievements are improved housing and access to clean water—even if it's a shared neighborhood tap—and economic programs that have helped double the black middle class.

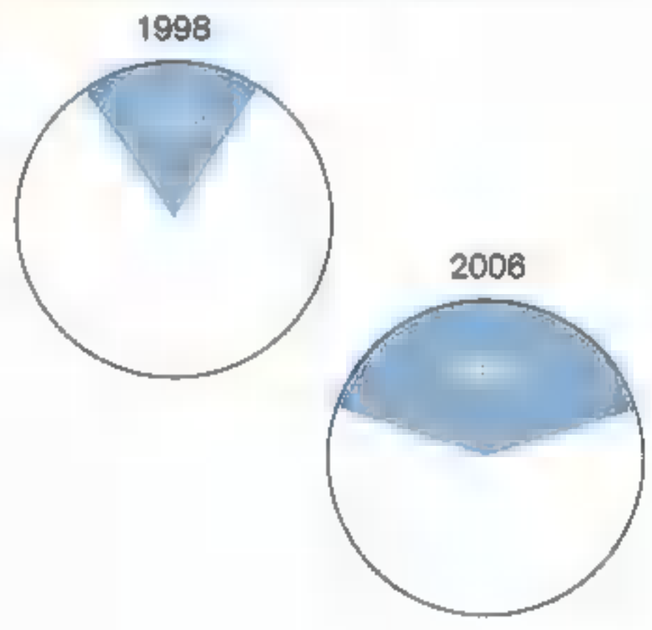
Subsidized housing completed or in progress



Share of households with access to clean water



Black middle class as percentage of total middle class

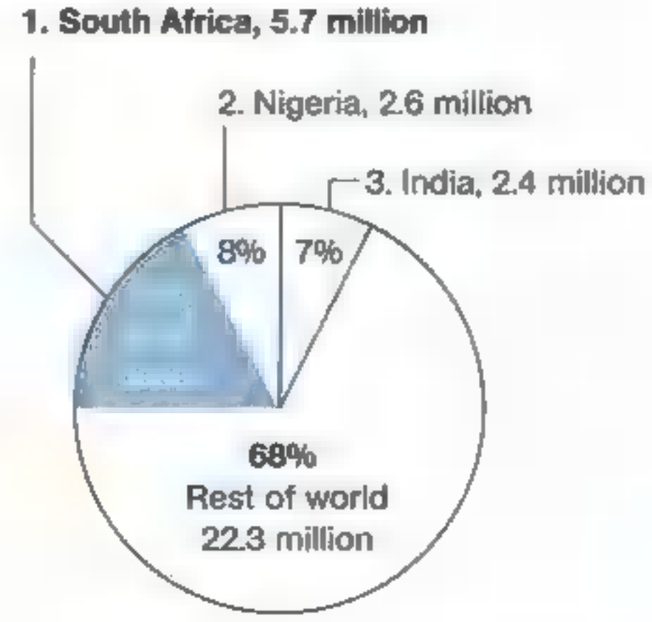


CRITICAL SOCIAL PROBLEMS

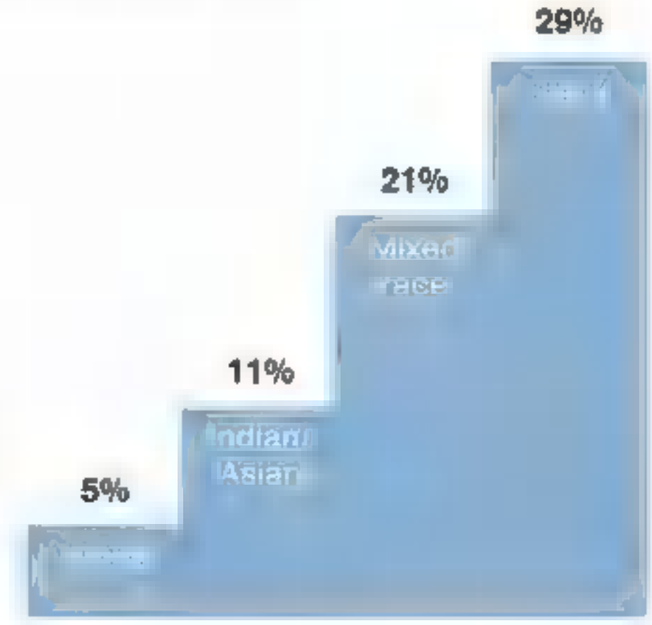
Violent crime, including one of the world's highest incidences of rape, and the world's greatest number of HIV/AIDS cases compound the economic challenges.

Violent crime
Per 100,000 people

HIV/AIDS
Top three countries, 2007



Unemployment
Within racial group, 2009



MAP: MARTIN GAMACHE, NGM STAFF. GRAPHICS: JOHN TOMANIO AND MARGUERITE B. HUNSIKER, NGM STAFF

MAP SOURCE: AGRICULTURAL GEO-REFERENCED INFORMATION SYSTEM, SOUTH AFRICA. GRAPHICS SOURCES: NATIONAL INCOME DYNAMICS STUDY, UNIVERSITY OF CAPE TOWN (POVERTY); *DEVELOPMENT INDICATORS 2009*, REPUBLIC OF SOUTH AFRICA; STATISTICS SOUTH AFRICA; SOUTH AFRICAN POLICE SERVICE AND FBI (CRIME); UNAIDS (HIV/AIDS)

GIVING COMFORT A caregiver bathes and cradles the head of ■ patient receiving home care from Pretoria's Thola-Ulwazi hospice, which provides free services to 700 people with AIDS and tuberculosis. "There is no other place in our area where they could receive help," says director Venile Lekhwane.

ROUGH JUSTICE A Cape Town police officer subdues a suspect during a court-ordered search in Cape Flats, a violence-ridden district. Police stripped the man but did not arrest him. Infamous for gang wars and illicit drugs, Cape Flats is emblematic of South Africa's urgent need to curtail crime.

SOWETO RISING Its transformation from chaotic township to thriving Johannesburg suburb got ■ boost when the 700,000-square-foot Maponya Mall opened in 2007. Named for its developer, teacher turned entrepreneur Richard Maponya, the glass-and-steel hub draws 1.5 million people ■ month.

DAY IN THE SUN Young marrieds Felicity Nyikadzino Berold and Ralph Berold, both 33, enjoy a game of Scrabble near Johannesburg's Zoo Lake. "Things have changed a lot in the past ten years," Ralph says. "There are subtle forms of prejudice, but the younger generation is ■ lot more relaxed about diversity."

(Continued from page 93) with Jobson—a disarmingly mild-mannered doctor in her 50s—from Johannesburg, and we're driving through the outskirts of Pretoria on a blameless summer afternoon in late 2009. From here, South Africa's administrative capital seems all flowering impatience—50,000 jacarandas lend the city a mildly campy glamour, and the streets are lined with beds of agapanthus. Advertisements for the World Cup are everywhere; a high-speed-train track is being built parallel to the road.

"Everyone was exhausted by 1994. I think they just wanted apartheid to go away and the government to fix everything. But that didn't happen," Jobson says. "It's up to each individual South African to participate actively in restitution. You know, the power of one. The power one person has to perpetuate our violent past, or the power one person has to contribute to a just, peaceful society."

In this way our conversation comes back to Coetzee. Sometime in 2004 Jobson received a phone call from Eugene de Kock. Over the years de Kock has tried to help Khulumani locate people who disappeared during the struggle, describing in some detail the manner in which they vanished, mostly because he was responsible for what happened to them. De Kock told Jobson that he had become acquainted over the previous couple of years with a young man called Stefaans Coetzee. "Stefaans wanted to meet with his victims and apologize for what he had done," she says. Jobson wasn't opposed to being helpful. The only problem was that Coetzee had no idea who his victims were. He could give no names and—beyond the fact that three of the dead had been children—no identifying characteristics.

"IT'S UP TO EACH SOUTH AFRICAN TO PARTICIPATE IN RESTITUTION. YOU KNOW, THE POWER OF ONE," MARJORIE JOBSON SAYS. "TO PERPETUATE OUR VIOLENT PAST, OR TO CONTRIBUTE TO A JUST, PEACEFUL SOCIETY."

THE PRESIDENTS

In 2005 Thabo Mbeki, in his second term as South Africa's president, fired Jacob Zuma, the deputy president. Zuma had been implicated in a corruption scandal involving a five-billion-dollar arms deal. (Charges were dropped in April 2009.) Mbeki must have thought ridding himself of this troublesome high priest of populism was a safe bet. But it turned out to be the political kiss of death, causing a deep split within the ruling party, the African National Congress, or ANC. By the end of the year Zuma's supporters were burning T-shirts with Mbeki's face on them.

Zuma and Mbeki, although both longtime ANC activists, could not be more unalike. Mbeki is a Xhosa from the Eastern Cape, highly educated and emotionally remote. Zuma is a Zulu from KwaZulu-Natal with no formal education who served a decade-long sentence on Robben Island for opposing apartheid. A charismatic man of action, he has three wives and a rape allegation to his name. (He was acquitted in 2006.)

In 2007 Mbeki announced to both houses of parliament that he had authorized a special dispensation for pardon applications for politically motivated crimes that had taken place between 1994 and 1999. Mbeki's official explanation was that he wished to finish the business of the Truth and Reconciliation Commission. Unofficially the move was seen by some as an effort to gain much needed support for the flagging president. The next year ■ group with a representative from each of the 15 official political parties recommended 120 prisoners for presidential pardon.

"It was an attempt to reach out politically," Tshepo Madlingozi of the University of Pretoria

says. But the process ignored something that had been at the moral, emotional, and political heart of the TRC—the victims would not be consulted before prisoners were granted amnesty. To human rights groups, this special dispensation was not about reconciliation; it was about political expediency, about closing the door and moving on. Eight organizations, including the Khulumani Support Group, filed a lawsuit, which eventually found itself at the Constitutional Court of South Africa, the highest court in the land, on November 10, 2009. By then Mbeki had resigned, and Zuma—JZ as he is popularly known—was president.

THE GO-BETWEEN

On the list of political prisoners identified for possible pardon, one name jumped out at Marjorie Jobson: the man Eugene de Kock had telephoned her about from prison, Stefaans Coetzee. Meanwhile, Khulumani had reached out to the victims, including Olga Macingwane, of those on the list.

A glance through Jobson's modest home in Grahamstown in the Eastern Cape reveals books everywhere, piled on furniture in the sitting room, in stacks on the floor, across the dining room table. "On the one hand, the Khulumani group was part of a lawsuit to ensure that the rights of victims were taken into account in this pardoning process," Jobson says, clearing books off the kitchen table so we can eat lunch. "On the other hand, I was getting more calls all the time from Stefaans's social worker and his minister, begging me to see if I could get him together with his victims. Not surprisingly, the victims of the Worcester bombing were skeptical. They had questions. Why does he want to meet us now? How is it going to benefit us? Is he feeling guilty now? Has he really had a change of heart?" Jobson sets a bowl of chicken noodle soup in front of me. In her distraction, she fails to eat at all. "I was interested in justice," she continues, "but I was most interested in the process of reconciliation. It was a conundrum." In the end Jobson appealed for help to a trusted colleague: Tshepo Madlingozi.

On the day I meet him in his law faculty office, Madlingozi is wearing black jeans, a long-sleeved, blue dress shirt with the sleeves rolled up, and casual leather sneakers. Our conversation is accompanied by the customary cup of tea. "Rooibos or normal?" Madlingozi had asked, offering either South Africa's native herbal tea or ordinary black tea. Now he blows into his cup and looks at me over the rim. "We made a decision that I should go and see Coetzee and see if he was for real. I was very nervous, very skeptical. I didn't know how I was going to react."

A day in mid-April 2009 was set for a meeting between Madlingozi and Coetzee in the social worker's office at Pretoria Central. "I was expecting someone in my imagination that looked very racist, you know, not this guy who walks into the office. I see a boy the same age as me. He's somehow handsome, very diffident. He was surprised too. He was expecting to see an old, radical, militant ANC activist."

Madlingozi shook hands with Coetzee and introduced himself. Coetzee shook Madlingozi's hand and thanked him for coming. The two men sat for a couple of hours and talked. "Mostly about ourselves," Madlingozi says. "What does he miss in prison? How did I become a lawyer? How did he become a prisoner? What do we hope for ourselves? What do we hope for our country?"

Madlingozi is a few months younger than Coetzee. He was born in Mangaung township, the area set aside for blacks outside Bloemfontein in the former Orange Free State—geographically not far from where Coetzee was born but a world away in terms of culture. "It was semidesolate and very violent," he says. Madlingozi's father was a migrant worker in the gold mines. "Migrant labor was one of the most devastating aspects of the system of apartheid," Madlingozi says. "It destroyed families. It destroyed communities. It was a way for the apartheid government to get capitalization, but it emasculated men who couldn't be at home to provide for their families. The fathers couldn't pass on folklore, culture, values. For the families left behind, it meant the father came back after three months and didn't know his place in the family. A lot of men asserted their position through violence."

Madlingozi's father died of a heart attack when his son was 14. "My mom and I had just relocated to a mining town to be near him. We were just becoming friends again. He had a

voracious appetite for reading novels, and we read together a lot." Madlingozi finished his schooling in Welkom, a gold-mining town laid out in the late 1940s by the Anglo American Corporation. The mines in and around the town are very deep. Each morning, brackish water is pumped from them into pans on the surface. Flocks of flamingos, Egyptian geese, and sacred ibises congregate on the pans. The air is stung with the scents of salt and bird droppings.

Madlingozi leans forward. "Meeting Stefaans has reignited my faith in the future of South Africa," he says. "My worldview is black consciousness, and that hasn't changed as a result of knowing Stefaans. But it has made me appreciate that even the most ardent racists—even murderers—can change and be humble. Yes, Stefaans's intelligence, humility, acute appreciation of the consequences of his actions and the system of apartheid, as well as his appreciation that reconciliation is not merely about showing goodwill, have greatly inspired me." Madlingozi has both hands under his chin now. "I can see how there might be people criticizing me for selling out. How can I visit this man? How can I have empathy? But this isn't just about winning. It can't be about winning. If we only want to win, then there will always be losers, and how is that so different from the way things were? This has always been about the big picture, about moving on together." Then he laughs and looks at me, almost challengingly. "Mmm, it's complicated, messy—it can be very personal and always in shades of gray. But that's where reality is. That's where we are. That's what we have to work with."

THE VICTIM

From Worcester to Pretoria is a two-day drive—16 hours, more or less. Marjorie Jobson has arranged for Olga Macingwane and three other residents of Zwelethemba to rent a car and drive up for the constitutional court hearing on November 10, 2009. The four of them agree to meet Stefaans Coetzee the day before the hearing, but only on the condition that they are not doing so to forgive him. "I am not there to forgive him," Macingwane says firmly. "I am there to face the man in my head. I want to hear what he has to say for himself. But no, I am not there to forgive him."

Life became difficult for Olga Macingwane after the bombing, and not only for all the obvious reasons. Cadres of the ANC used the funerals for political posturing, racing disabled survivors of the attack through the streets in their wheelchairs, all the while chanting songs made popular during the struggle. Then in 2003 Macingwane's husband died, and without his support, she could no longer afford to raise their three children. They were sent away to live with relatives. A laminated photograph of Macingwane's husband reveals the exact match you would pick for Olga. He stands before a 1970s polished yellow Datsun in a three-piece suit exuding an aura of conservative reserve. The yellow car is still parked outside Macingwane's house, dormant under a thick gray blanket.

November 9 is a hot day. Macingwane and the other three residents of Zwelethemba—including Harris Sibeko, husband of the deputy mayor at the time of the attack—walk into the social worker's office at Pretoria Central and see Coetzee standing in the corner in his orange jumpsuit stamped with the word "prisoner." "I was shocked," Macingwane says later. "What I see is a boy. Not the man I have had in my mind all these years, but a boy. What is this boy doing here? How did it happen? That is what is inside my head all of a sudden."

Macingwane asks to begin with a prayer. In the ensuing silence she gets to her knees—laboriously, because two days in a rental car have done nothing to help the pain in her legs—and begins to pray in Xhosa. She praises God for his hallowedness. She thanks God for bringing South Africa another day. She asks God to forgive her trespasses, as she will forgive others their trespasses against her. She asks God to see that his will be done in this room today. Then she takes her seat. While her colleagues mop their brows and fan themselves against the heat, Macingwane maintains her composure.

The meeting takes place in a mixture of Xhosa, Afrikaans, and English. Macingwane is mostly silent. "He must explain himself before I speak," she says at the outset.

Coetzee does not talk about his childhood. He speaks about the planning that went into the bombing, how he was chosen for his excellent military skills, the years he has spent in prison. He asks for their questions, and the group responds. How did he learn to hate black people?

How did he unlearn this hatred? How does he spend his days now? Is he sorry? And if he is so sorry, what can he give them? Coetzee admits he has nothing material to give the world except the leather belt that holds up his overalls. But, he says, God willing, if he gets out of jail, he can begin to attempt to compensate for what he has done. "There are children now in South Africa," he says, "children without parents. They might be tempted to get into violent gangs, to follow anger instead of love." He says, "I can show them that the first life you have to change is your own."

When Coetzee is asked about the dreams he has for his future, he says he would like to get married. He says he will have to tell his future wife and any children he may have that he is a murderer.

Now Harris Sibeko intervenes. "Listen here, chief, you must wait until a child is old enough to understand what you are telling them, otherwise the child will hate you." Sibeko turns to the group and asks, "Do you really think we can call this young man a murderer? What do you think is a better name for him?" Then Sibeko answers his own question. "I think you should be called a military operative. Yes, that would be better."

The group agrees with Sibeko. Then Sibeko asks Coetzee whether he receives any visitors in jail. Coetzee replies that one former prisoner comes sometimes. Sibeko is shocked. "None of your family visit you?" Coetzee replies, "No."

The interview goes on for two hours. Finally, Olga Macingwane gets to her feet. Unusually, she is fighting with her emotions. She says, "Stefaans, when I see you, I see my sister's son in you, and I cannot hate you." She extends her arms. "Come here, boy," she says in Xhosa. Coetzee walks into her embrace. "I forgive you," Macingwane says softly. "I have heard what you said, and I forgive you."

THE LAW

On that day Daniel Stephanus Coetzee became the only one of the 120 political prisoners eligible for presidential pardon to meet with his victims. The next day, November 10, the Constitutional Court of South Africa, with four new judges appointed by President Zuma, convenes. The first order of business is to hear arguments about whether or not the president should be allowed to pardon any of the political prisoners without a hearing for their victims. Zuma's attorney argues for unfettered pardoning powers. The attorney representing one of the prisoners also argues for such powers. But an attorney for the human rights groups urges that no political criminals be pardoned without the victims of those crimes being heard. (On February 23, 2010, the constitutional court ruled in favor of the victims.)

Present in the court are some three dozen victims of political crimes involving any number of perpetrators. Several of the victims are wearing T-shirts that read, "No reconciliation without truth, reparation, redress." Among them is Olga Macingwane.

"I forgive him, but that does not mean I pardon him," Macingwane tells me afterward. "We are a country of laws now. We are a country who respects the voices of all people. It is up to the laws of my country to decide whether or not to pardon Stefaans."

For too long, separation and suspicion were mandated by South African law. Now the country's constitution upholds the dignity and equality of all people, but its power is only as potent as the people's willingness to live by it. On January 23, 2010—as long envisioned by minister Deon Snyman—representatives of Worcester and of Zwelethemba township gather in Worcester's Dutch Reformed Church. Across the road in a wide, shady park lies a tiny memorial to the four people killed in the 1996 bombing. The proceedings begin with a prayer. Then Macingwane and Sibeko talk about their journey to Pretoria, their meeting with Coetzee, their forgiveness of him. Restitution is discussed—a youth center and a job-creation center are two ideas. The group agrees to invite Coetzee to a church service in Worcester if the prison authorities will allow it. The date for another meeting is set. Olga Macingwane is elected to the steering committee, which will oversee the restitution process in the months and years to come.

"When I forgave Stefaans," Macingwane says, "that label of 'victim' no longer had such power for me. Physically, of course, the pain will always be there. Mentally, I have at last found some peace. I am not Olga the victim. Now I am Olga. I am Mrs. Olga Macingwane." □

LOOKING AHEAD A woman in Soweto gazes past ■ length of lace draped to dry on razor wire set up to deter criminals. Mandela's words after ■ landmark 1976 uprising against apartheid by Soweto youths still ring true: "Much has been achieved and much remains to be done."

DISCOVERY *in the*

A BIOLOGICAL EXPEDITION TO A REMOTE NEW GUINEA RAIN FOREST

EXPLORES A WORLD OF BIZARRE AND BEAUTIFUL CREATURES,

AMONG THEM A SPIKE-NOSED TREE FROG,

THE GOLDEN-FRONTED BOWERBIRD, AND A TINY INCHWORM MOTH

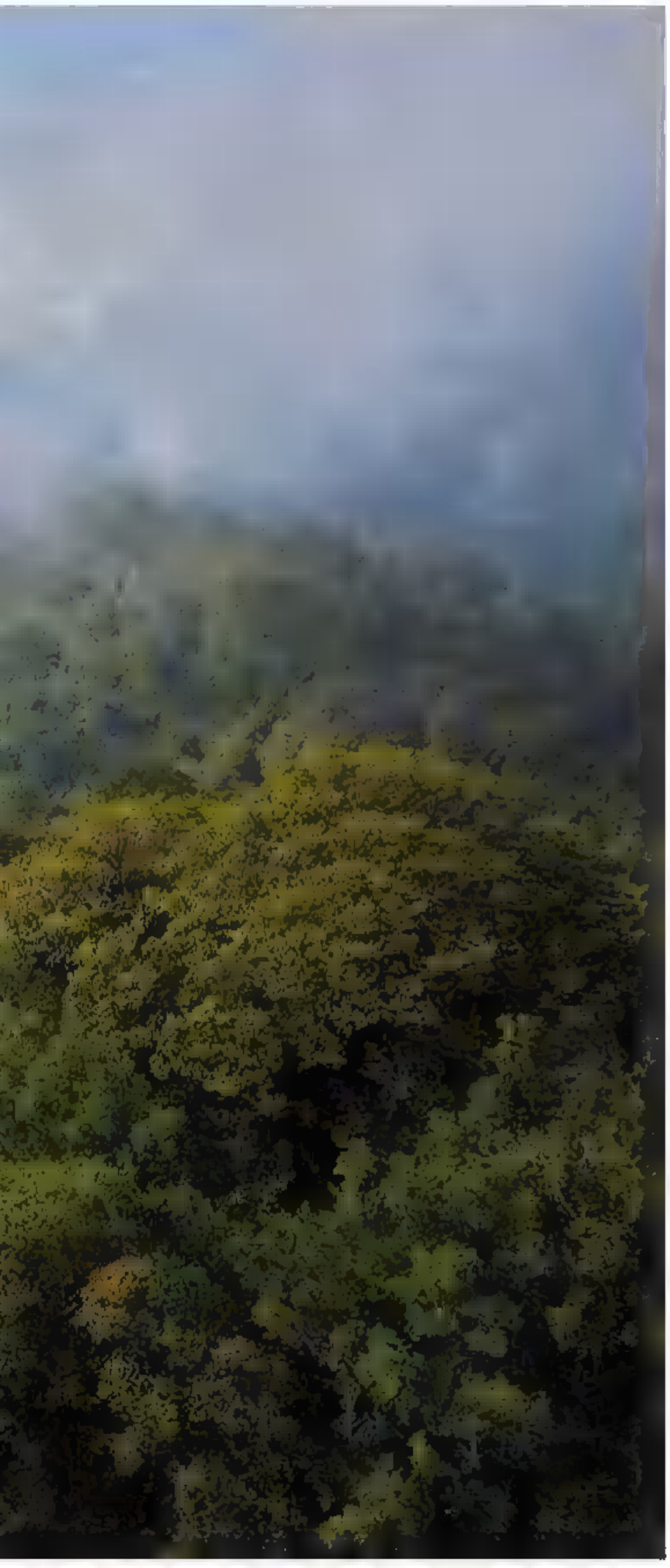
AS FANTASTIC AS ANY COMPUTER-GENERATED SCI-FI MONSTER.

FOJA MOUNTAINS

Near a tent serving as a makeshift laboratory, Australian herpetologist [illegible] Oliver records the call of a frog out [illegible] about [illegible] start of the rainy season. Daily downpours nourish the Foja Mountains' diverse life but create difficult conditions for scientists who must trudge miles on steep, muddy trails to research sites.

By Mel White Photographs by Tim Laman

Rising over 7,200 feet, New Guinea's Foja Mountains stand above surrounding lowland forest as a virtual island where species have evolved in isolation for millennia. No evidence has been found of human occupation in the higher reaches, and animals gone from other New Guinea ranges still thrive here.



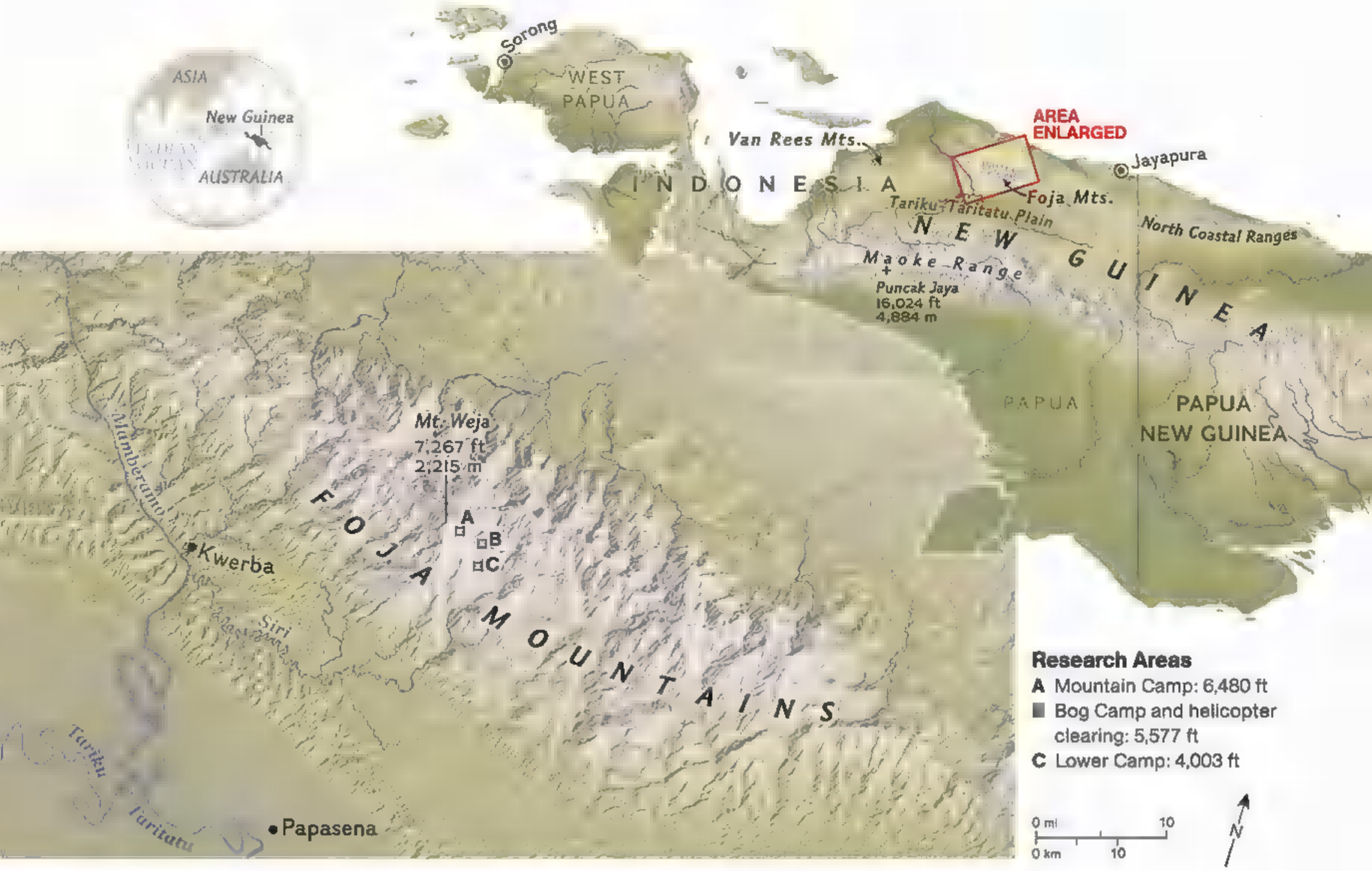
Brother Henk is remaining remarkably calm about the loss of his clothes. Only hours ago a helicopter dropped him into an opening in the rain forest a mile high in the Foja Mountains on the island of New Guinea, one of the remotest and most difficult to reach places on Earth. The sound of the chopper blades had barely faded when he discovered that his duffel bag was nowhere to be found and what he was wearing—a bucket hat; pink, short-sleeved shirt; jeans; and rubber boots—composed his entire wardrobe for the next three weeks.

Yet Henk van Mastrigt is very happy. Holding his red net, he stalks across a muddy bog, lunging at and occasionally catching one of the jewel-bright butterflies that dart by. "Come down, come close, don't be afraid," he calls to them in his Dutch accent. He stops to urinate on the mud, knowing butterflies will be attracted to minerals in the puddle.

Brother Henk catches a medium-size butterfly. With blunt-ended tweezers he spreads its wings, which are deep black with J-shaped markings in gleaming white. "Oh, this is great, great, great!" he says, a huge smile on his white-bearded face. "Surely a new species to science."

Though he is a Franciscan lay brother and not a formally trained biologist, he's spent decades studying the butterflies of western New Guinea and knows them as well as anyone. If Brother Henk has never seen this bug before, no one has. It's like being present at the creation—or, in one sense, even before the creation, since by the rules of science this species won't exist until it's deposited in a museum and Brother Henk publishes its description in a journal.

"Look, there is the new honeyeater," Brother



Henk says, pointing toward the green wall of vegetation at the edge of the bog. A medium-size bird with blackish feathers and brilliant orange flaps of bare facial skin hops through a shrub, picking fruit with its beak. It is a wattled smoky honeyeater, a species found only in the Foja Mountains. Perhaps a dozen scientists have ever seen it alive.

THE WORLD'S SECOND LARGEST ISLAND, New Guinea has for centuries intrigued and challenged even the most adventurous and experienced scientists. In the mid-1800s legendary explorer-scientist Alfred Russel Wallace, who had seen more than a few wild places, wrote that the rugged and densely forested New Guinea landscape presented "an almost impassable barrier to the unknown interior"—a statement that remained true throughout much of the 20th century. As scientists gradually explored other ranges, the Fojas' deep valleys, sheer cliffs, knife-edge ridges, and unbroken forest canopy resisted exploration until biologist Jared Diamond conducted surveys in 1979 and 1981.

In 2004 ornithologist Bruce Beehler flew over the Fojas and spotted a small clearing in the forest, a bog where annual flooding restricts plant growth to shrubs and grasses—and, more important, where a helicopter could land. In late 2005 Beehler led the first intensive scientific expedition to the Fojas, a 25-day trip conducted by Conservation International's Rapid Assessment Program (RAP), designed to provide biological information to facilitate environmental protection for areas of important biodiversity. During the expedition, members discovered the wattled smoky honeyeater (the first new bird species found in New Guinea since 1950), more than a dozen new frogs, and several mammal and plant species. Henk van Mastrigt collected more than two dozen types of butterflies and moths, now under study as possible new species.

BROTHER HENK was back for the second RAP expedition to the Fojas in November 2008, and thanks to donations from team members, he did not spend the entire three weeks in a single set

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Mel White wrote about New Zealand's Tongariro National Park for the July 2009 issue. Tim Laman journeyed to New Guinea to photograph birds of paradise for the July 2007 issue.

MARTIN GAMACHE, NGM STAFF
SOURCE: NEVILLE KEMP; CONSERVATION INTERNATIONAL; CENTER FOR INTERNATIONAL FORESTRY RESEARCH

Middle of Nowhere

The Foja expedition (map), in cooperation with the Indonesian Institute of Sciences, gained access to the mountains from the land-owning Kwerba and Papasena villages. Locals guided scientists, sharing knowledge of flora and fauna. Pristine rain forest is home to the long-beaked echidna (right). Related to the platypus, this nocturnal worm-eater is the largest egg-laying mammal in the world. An echidna can weigh up to 36 pounds.

of clothes. It was a good thing too, because the torrential rain meant that even those with plenty of clothing spent much of their time with sodden shirts, damp pants, and squishy socks.

The rain, of course, fuels the forest's rich life, manifested in part by lush mosses, ferns, and other epiphytes—plants that grow on other plants—covering tree trunks and limbs. High enough in elevation to be above malarial mosquitoes and known poisonous snakes, residents of the aptly named Bog Camp saw their major threat in falling branches, as epiphytic vegetation soaked up water and stressed limbs, which cracked with the staccato of artillery fire.

Among the dozen or so tents at Bog Camp was a large yellow one that served as a makeshift laboratory, where expedition biologists preserved skins, skeletons, whole animals, and bits of tissue to be taken away for later study and DNA analysis. Here, Kristofer Helgen and Christopher Milensky of the Smithsonian Institution prepared, respectively, mammal and bird specimens, and Australian Paul Oliver worked on frogs and lizards. Ornithologist Ed Scholes of the Cornell Laboratory of Ornithology carried video and audio recorders along forest paths, documenting rare birds of paradise. Botanist Asep Sadili of the Indonesian Institute of Sciences, which cosponsored the expedition, collected plants from a study site near camp.

Team members captured animals in various traps and nets and, in some instances, by hand (especially in the case of frogs found by headlamp light on night walks). Many of the larger birds and mammals were brought in by men from a village in the Foja foothills who guided biologists, helped with camp chores, and demonstrated time and again their near-magical knowledge of the ways of the forest.

On the second day of the expedition, three of the hunters returned from a walk carrying a dwarf cassowary, freshly shot with bow and arrow. Though Milensky coveted the three-foot-tall bird, the local men had other ideas, and soon the air was filled with the smell of roasted cassowary. Milensky salvaged the bones. As he laboriously cleaned a femur, he declared, "This may be the first wild-caught specimen for any museum in the past hundred years."

Hunters presented Kris Helgen with other treasures: a tiny wallaby—"It could be the world's smallest true kangaroo," he said of the

A golden-mantled [illegible]
kangaroo triggered a
camera and strobes as it
crossed [illegible] infrared beam.
Few scientists have seen
the arboreal marsupial in
the flesh. The Fojas
provide a vital refuge for
the species, critically
endangered by hunting
and habitat loss elsewhere
[illegible] the mountains on [illegible]
island of New Guinea.

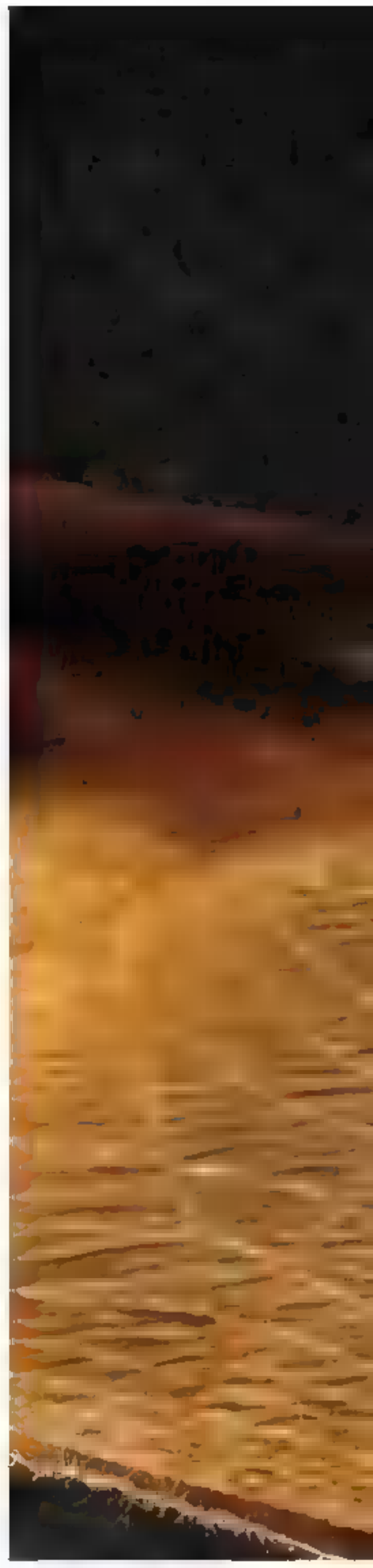
Creatures of the Night

When the sun sets in the Fojas, hundreds of species of rain forest inhabitants emerge in the dark to take the place of those retiring for the night. As Indonesian entomologist Hari Sutrisno demonstrates (right, top), a couple of lightbulbs and a sheet are enough to attract scores of moths of staggering diversity. (A small sampling, each with about a one-inch wingspan, is shown above.) Night, especially during gentle rain, is also the best time to find frogs, located by their frequent calls and by the silvery shine of their eyes in a flashlight beam. (Specimens at right are in the one-to-three-inch range.) New Guinea is home to around 350 frog species; an equal number may be awaiting discovery on the island, which remains among the world's least known regions.

cottontail-size animal—and a rare, bizarre, long-beaked echidna. This monotreme, an egg-laying mammal related to the platypus, possesses a snout with electroreceptors that help it locate earthworms, which it spears with a harpoon-like, barbed tongue and slurps into its toothless mouth like strands of spaghetti. "This thing is the weirdest mammal in the world," Helgen said, acknowledging, among other attributes, the echidna's muscular body, its sharp spines formed from modified hairs, the female's production of milk through mammary patches (there are no nipples), and the male's four-pronged penis. "It's my favorite mammal," he added—a fact surely not unrelated to the animal's surpassing strangeness and to the challenge of studying it. No one—no scientist, no known New Guinea tribesperson—has ever seen a baby long-beaked echidna.

Daily life in camp came with costs beyond the work of collecting and preparing specimens. Leeches left bloody welts on everyone's legs; nettles caused painful rashes. One night, figuratively at least, it rained maggots inside Helgen's tent. Flies had laid hundreds of eggs on the mesh tent top, and the larvae had hatched, wriggling and hungry. Another night one of the local men ruined the team's entire supply of kerosene when he mistook it for water, poured it into a pot, and added rice to cook dinner. Still, no one stayed discouraged for long at Bog Camp.

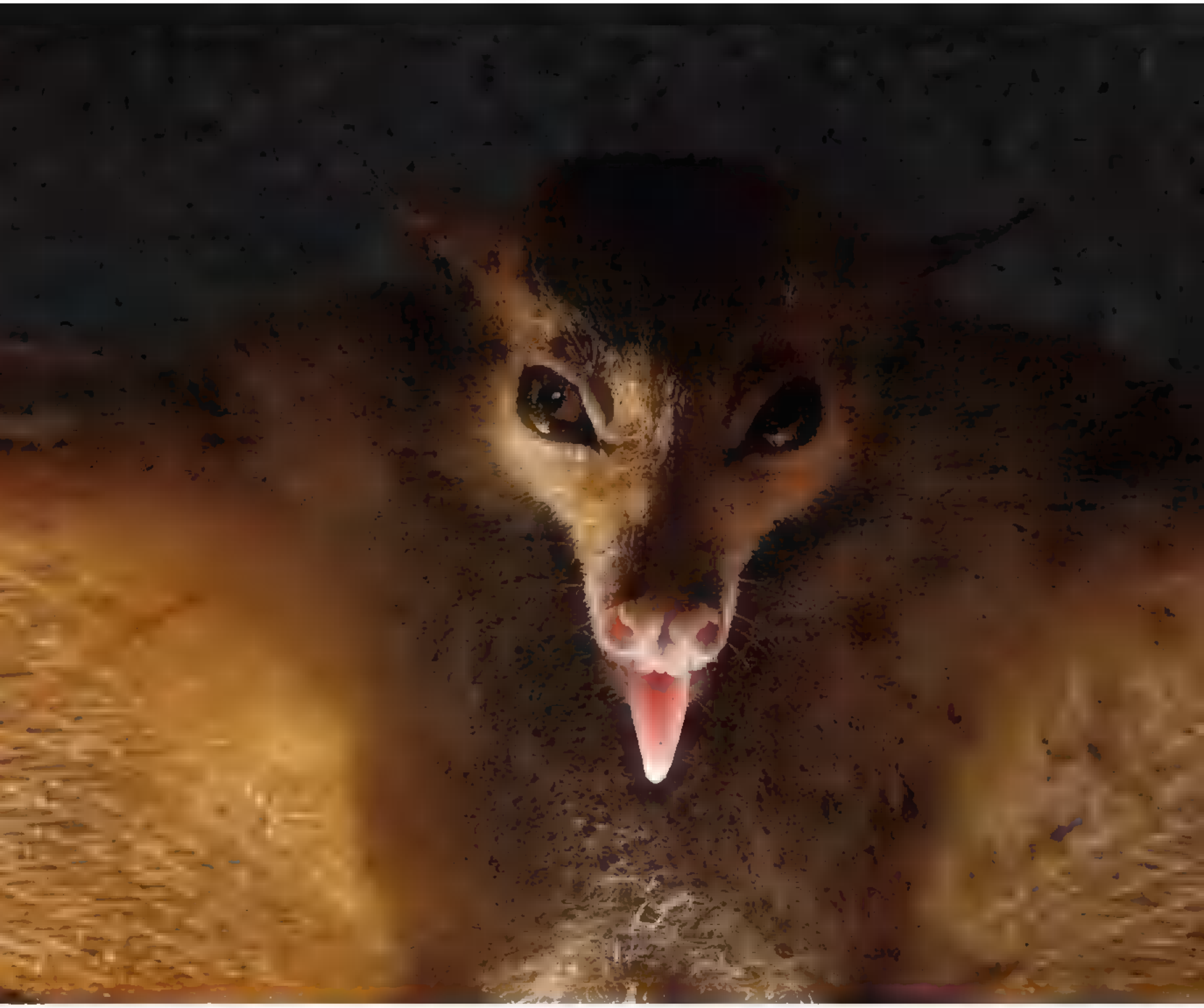
Daylight began with birdsong—especially that of the loud and ubiquitous lesser ground-robin, whose notes recall the first two bars of Scott Joplin's "The Entertainer." The daily routine was punctuated by the harsh screeching of flocks of small parrots called lorikeets, which zoomed overhead like red-and-green bullets; the constant *hooing* of white-breasted fruit-doves, which magically stayed hidden in the treetops despite brilliant green-and-yellow plumage; and the literally endless drip of water on tent tops. At day's end came the deafening calls of cicadas—the 5:30 type sounding like car alarms, the 6:00 type resembling police sirens. Then night fell, and frogs chimed in, peeping and beeping like a forest full of 1950s sci-fi robots gone insane.



Yet to be given a scientific name, this species of blossom bat uses its long tongue to feed on nectar from forest flowers, which it pollinates as it flies from plant to plant. Conservationists hope that discoveries in the Foja Mountains will provide incentive to protect the region from mining, logging, and other threats so the intact web of biodiversity can function naturally for generations to come.

Each day brought discovery and surprise, from the rare, indeed near-mythic, golden-mantled tree kangaroo (its scientific name is *Dendrolagus pulcherrimus*, which means "most beautiful tree hare") to the bounty of moths that Brother Henk collected every night, seeming to comprise every possible combination of shape and color.

But science isn't all eureka moments, and some of the scientists' prey proved maddeningly elusive. Near the end of the trip, ornithologist Ed Scholes returned from a day in the forest and sat, frowning, under the blue tarp that served as the dining room. He had hoped to record behavior proving that the parotia



(a type of bird of paradise) found in the Fojas was a species that may be distinct from those elsewhere in New Guinea.

"I'm up to a ratio of 400 to one," Scholes grumbled. "Four hundred minutes of sitting in that mosquito-infested pigsty of a blind to one minute of seeing the bird."

When three weeks were up, the list of discoveries had grown from Brother Henk's first-day butterfly to include an appealingly beady-eyed rat, a long-nosed frog caught while it rested on a sack of rice, a huge dragonfly with glittering yellow eyes, a gecko spotted by its fiery orange eyeshine, and many more butterflies and moths. The expedition's biologists found several new species and—even in the tiny fraction of the Fojas' expanse explored—greatly expanded knowledge of the ranges and abundance of New Guinea fauna and flora.

As the helicopter rose from the bog, team members looked out the windows to see flocks of huge white cockatoos, startled by the roaring engine, flying over dark green forest stretching to the horizon. The noise died away, the birds settled back into the treetops, and life in the Foja Mountains returned to centuries-old rhythms, its mysteries scarcely breached. □

Society Grant This project was funded in part by your National Geographic Society membership.

A 51-foot Buddha from the Middle Tang period (781-847) reclines to await death, when he will pass serenely into nirvana. Followers painted on the cave walls express their agony.

CAVE 158, SEE PAGE 128
PHOTOGRAPH COMPOSED OF THREE ADJACENT IMAGES
OVERLEAF: CAVE 260, PAGE 130

Caves of Faith

In a Silk Road oasis, thousands of Buddhas enthrall scholars and tourists alike.

BY BROOK LARMER PHOTOGRAPHS BY TONY LAW

A stand of poplars under the dunes of China's Gobi desert marks the presence of a seasonal river and a mile-long cliff carved by its waters. In the fourth century A.D. Buddhists began digging caves in the rock face and decorating the darkness with paintings and statues.

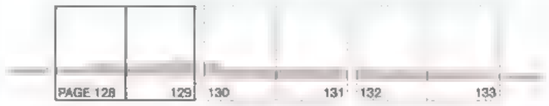
GALLERIES IN THE GROTTOES

One of the world's finest galleries of Buddhist art is found in 492 of the Mogao caves near Dunhuang, ■ Silk Road oasis in northwestern China. Carved between the fourth and 14th centuries, the caves offer a time capsule of an ancient world.

PANORAMA, COMPOSED OF HUNDREDS OF IMAGES: DUNHUANG ACADEMY
TIME LINE: NGM ART. SOURCE: QIANG NING, CONNECTICUT COLLEGE

The statue of a seated Buddha ■ Cave 130 is 89 feet tall, one of Mogao's three largest. Intricately patterned ceilings are meant to mimic hanging cloth, as in a tent.

Tang dynasty



DUNHUANG'S HISTORICAL PERIODS

Sixteen States	Northern Wei	Western Wei	Northern Zhou	Sui	Tang	*Tibetan rule*
366-439	439-534	535-556	557-580	581-618	618-906	*781-847*

A.D. 400 · 500 · 600 · 700 · 800

The human skeletons were piled up

like signposts in the sand. For Xuanzang, a Buddhist monk traveling the Silk Road in A.D. 629, the bleached-out bones were reminders of the dangers that stalked the world's most vital thoroughfare for commerce, conquest, and ideas. Swirling sandstorms in the desert beyond the western edge of the Chinese Empire had left the monk disoriented and on the verge of collapse. Rising heat played tricks on his eyes, torturing him with visions of menacing armies on distant dunes. More terrifying still were the sword-wielding bandits who preyed on caravans and their cargo—silk, tea, and ceramics heading west to the courts of Persia and the Mediterranean, and gold, gems, and horses moving east to the Tang dynasty capital of

A mural in Cave 217 depicts an imaginary city, conjured up by the leader of a pilgrimage to serve as a resting place for his weary followers.

Tang dynasty

Mogao's tallest Buddha, at 116 feet, peers out of Cave 96—a nine-story pagoda.

Tang dynasty

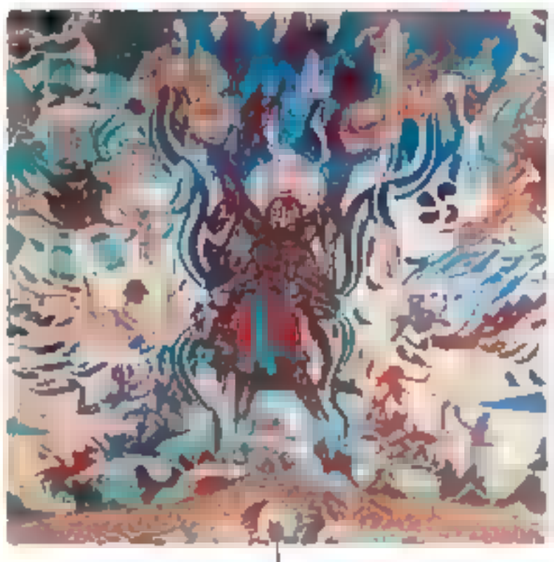
Changan, among the largest cities in the world.

What kept Xuanzang going, he wrote in his famous account of the journey, was another precious item carried along the Silk Road: Buddhism itself. Other religions surged along this same route—Manichaeism, Christianity, Zoroastrianism, and later, Islam—but none influenced China so deeply as Buddhism, whose migration from India began sometime in the first three centuries A.D. The Buddhist texts Xuanzang carted back from India and spent the next two decades studying and translating would serve as the foundation of Chinese Buddhism and fuel the religion's expansion.

Near the end of his 16-year journey, the monk stopped in Dunhuang, a thriving Silk Road oasis where crosscurrents of people and cultures were giving rise to one of the great marvels of the Buddhist world, the Mogao caves.

Emerging from the wind-sculptured dunes some 12 miles southeast of Dunhuang is an arc of cliffs that drop more than a hundred feet to a riverbed lined with poplar trees. By the mid-seventh century, the mile-long rock face was honeycombed with hundreds of grottoes. It was here that pilgrims came to pray for safe passage across the dreaded Taklimakan Desert—or in Xuanzang's case, to give thanks for a successful journey.

Within the caves, the monochrome lifelessness of the desert gave way to an exuberance of color and movement. Thousands of Buddhas in every hue radiated across the grotto walls, their robes glinting with imported gold. *Apsaras* (heavenly nymphs) and celestial musicians floated across the ceilings in gauzy blue gowns of lapis lazuli, almost too delicate to have been painted by human hands. Alongside the airy depictions of nirvana were earthier details familiar



Indian and Chinese figures twirl around a demon on the ceiling of Cave 249, a sixth-century gem, showing how other deities were incorporated into the Buddhist pantheon.

Western Wei dynasty

Patrons depicted in Cave 61 include women in Khotanese and Uygur dress—a sign of Dunhuang's tenth-century "marriage diplomacy" with regions to the west.

Five Dynasties

to any Silk Road traveler: Central Asian merchants with long noses and floppy hats, wizened Indian monks in white robes, Chinese peasants working the land. In the oldest dated cave, from A.D. 538, Xuanzang would even have seen those bandits again—only in this rendition, the thugs had been captured, blinded, and ultimately converted to Buddhism.

When Xuanzang passed through Dunhuang, he could not have known that his translations of the Buddhist sutras would inspire Mogao's artists for centuries to come. Nor could he have known that more than 1,200 years later his work would lead to the rediscovery and plunder, and ultimately the protection, of the grottoes. All the monk could see was that here, in a desert on the outskirts of the empire, the Buddhist faith was already being transformed with each stroke of paint in the darkness.

FOR A RELIGION that preaches the transience of all things, the ever shifting sands of China's western deserts might seem the perfect setting for such glorious artistic expression. But the miracle of the Mogao caves is not their impermanence but rather their improbable longevity.

Carved out between the fourth and 14th centuries, the grottoes, with their paper-thin skin of painted brilliance, have survived the ravages of war and pillage, nature and neglect. Half buried in sand for centuries, this isolated sliver of conglomerate rock is now recognized as one of the greatest repositories of Buddhist art in the world. The caves, however, are more than a monument to faith. Their murals, sculptures, and scrolls also offer an unparalleled glimpse into the multicultural society that thrived for a thousand years along the once mighty corridor between East and West.

The Chinese call them Mogaoku, or "peerless caves." But no name can fully capture their beauty or immensity. Of the almost 800 caves chiseled into the cliff face, 492 are decorated with exquisite murals that cover nearly half a million square feet of wall space, some 40 times the expanse of the Sistine Chapel. The cave interiors are also adorned with more than 2,000 sculptures, some of them among the finest of

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Brook Larmer wrote about Shanghai's dreams in the March issue of the magazine. Tony Law photographed a Tang shipwreck for the June 2009 issue.

A reclining Buddha occupies a niche surrounded by thousands of Buddha images in Cave 46.

Tang dynasty

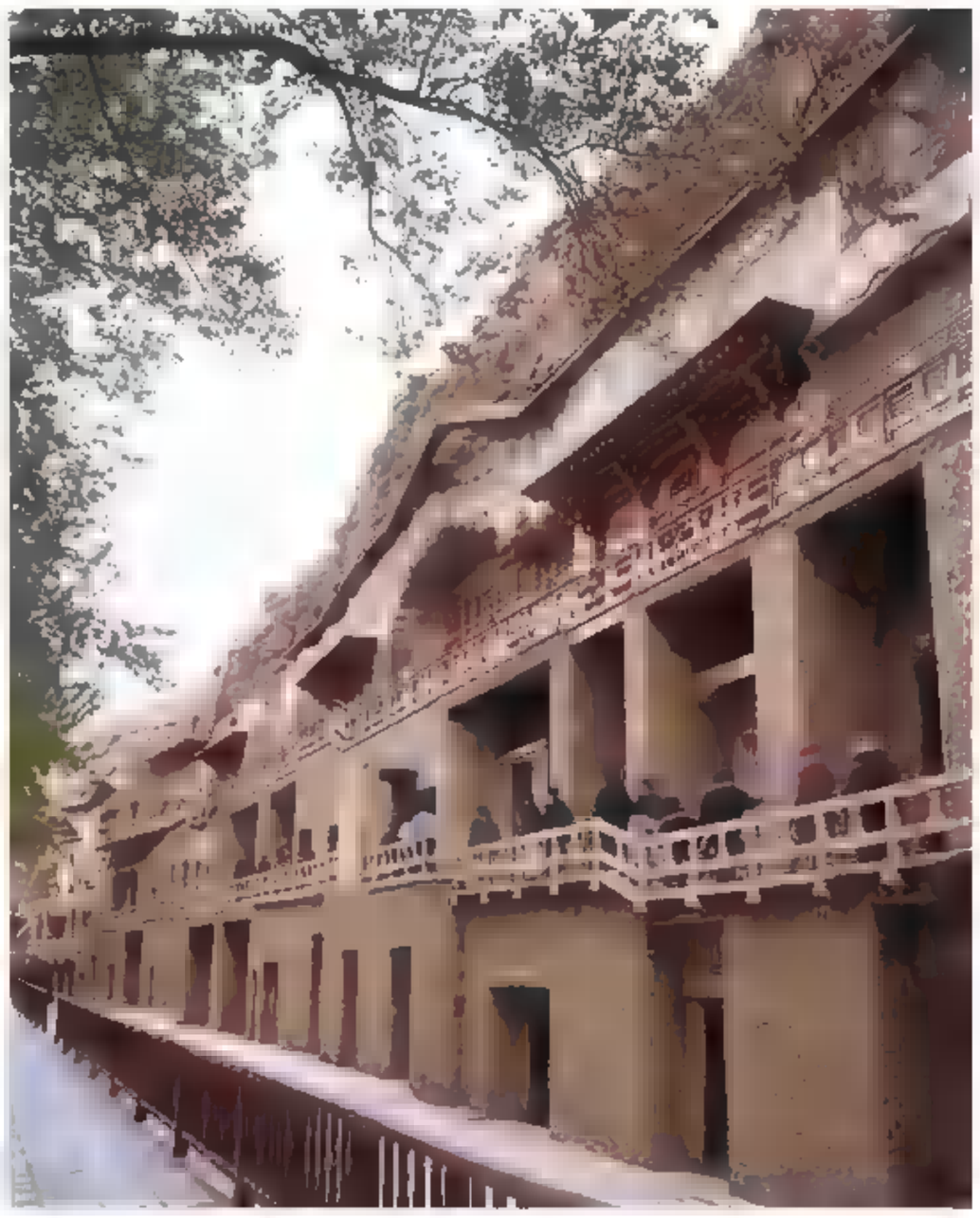
Floral garments worn by sixth-century statues in Cave 427 reflect the influence of Persia, some 2,500 miles away—demonstrating the flow of ideas and fashion along the Silk Road.

Sui dynasty

their era. Until just over a century ago, when a succession of treasure hunters arrived across the desert, one long-hidden chamber contained tens of thousands of ancient manuscripts.

Whether taking the longer northern route or the more arduous southern passage, travelers converged on Dunhuang. Caravans came loaded with exotic goods redolent of distant lands. Their most important commodities, however, were ideas—artistic and religious. It's no wonder that the Mogao painters, illustrating the greatest of all Silk Road imports, infused their murals with an array of foreign elements, from pigments to metaphysics.

"The caves are a time capsule of the Silk Road," says Fan Jinshi, director of the Dunhuang Academy, which oversees research, conservation, and tourism at the site. A sprightly 71-year-old archaeologist, Fan has worked at the grottoes for 47 years, ever since she arrived in 1963 as a fresh graduate of Peking University. Most other Silk Road sites, Fan says, were devoured by the desert or destroyed by successive empires. But the Mogao caves endured largely intact, their kaleidoscope of murals capturing the early encounters of East



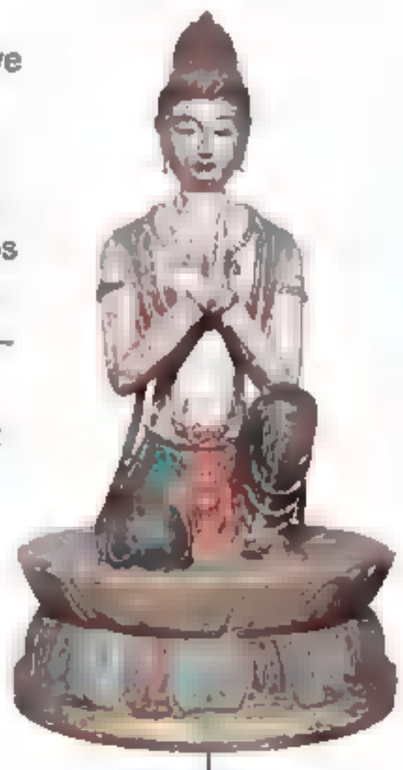
Tourists line up to see the art inside the Mogao grottoes, which opened to the public in 1980. Of the millions of visitors, nine out of ten are Chinese. The wooden facades were replaced mostly by concrete to withstand erosion.

The recurring Thousand Buddhas motif, here in Cave 320, illustrates the Mahayana doctrine of multiple Buddhas and evokes a dizzying sense of infinity.

Tang dynasty

Taken from Cave 328 in 1924, this statue of a bodhisattva—a being who helps others achieve enlightenment—now kneels in the Harvard Art Museum.

Tang dynasty



PHOTOS: HARVARD ART MUSEUM/ARTHUR M. SACKLER MUSEUM (STATUE); BRITISH LIBRARY BOARD OR. 8210/P2 (FRONTISPIECE)

and West. "The historical significance of Mogao cannot be exaggerated," Fan says. "Because of its geographical location at a transit point on the Silk Road, you can see the mingling of Chinese and foreign elements on nearly every grotto wall."

Today East and West are converging again on Dunhuang, this time to help save the grottoes from what may be the biggest threat in their 1,600-year history. Mogao's murals have always been fragile, the thinnest tissue of paint caught in a corrosive battle between rock and air. Over the past few years, they have faced the combined assault of natural forces and a surge of tourists. In an effort both to conserve the Silk Road masterpieces and to contain the tourists' impact, Fan has enlisted the help of teams of experts from across Asia, Europe, and the United States. It is a cultural collaboration that echoes the glorious history of the caves—and may help ensure their survival.

THE CAVES BEGAN as a vision of light. One evening in A.D. 366, a wandering monk named Yuezun saw a thousand golden Buddhas blazing in a cliff. Inspired, he chiseled a small meditation cell into the rock; others quickly followed. The first caves were no larger than coffins. Soon, monastic communities began carving out larger caverns for public acts of devotion, adorning the shrines with images of the Buddha. It is these early grottoes that inspired the nickname the Caves of the Thousand Buddhas.

Their canvases consisted of nothing more than river mud mixed with straw, but Dunhuang's artists would, over the centuries, record on these humble surfaces the evolution of Chinese art—and the transformation of Buddhism into a Chinese faith.

One of Mogao's creative peaks came during the seventh and eighth centuries, when China projected both openness and power. The Silk Road was booming, Buddhism was flourishing, and Dunhuang was paying fealty to the Chinese capital. The Tang cave painters displayed a fully confident Chinese style, covering whole walls with minutely detailed Buddhist narratives whose color, movement, and naturalism made the imaginative landscape come alive. The Middle Kingdom would later turn inward, finally shutting itself off from the world during the Ming dynasty in the 14th century.

The woodblock frontispiece from the world's oldest printed and dated book, the ninth-century Diamond Sutra, was removed from Cave 17 and now sits in the British Library.

Tang dynasty

The 13th-century tantric murals in Cave 465 are among the last—and most sexually charged—images created at Mogao.

Yuan dynasty

The natural, fluid poses of the Buddha's entourage characterize the High Tang period, when historians say both Buddhism and art reached their highest expression in the grottoes.

CAVE [illegible] PAGE 131
PHOTOGRAPH COMPOSED OF THREE ADJACENT IMAGES

"Unlike Indian Buddhists, the Chinese wanted to know in detail all the forms of the afterlife," says Zhao Shengliang, an art historian at the Dunhuang Academy. "The purpose of all this color and movement was to show pilgrims the beauty of the Pure Land—and to convince them that it was real. The painters made it feel like the whole universe was moving."

More earthly tumult periodically swept through Dunhuang. Yet even as the town was conquered by competing dynasties, local aristocracies, and foreign powers—Tibet ruled here from 781 to 847—the creative enterprise at Mogao continued without pause. What accounts for its persistence? It may have been more than a simple respect for beauty or Buddhism. Rather than wiping out all traces of their predecessors, successive rulers financed new caves, each more magnificent than the last—and emblazoned them with their own pious images. The rows of wealthy patrons depicted on the bases of most murals increased in size over the centuries until they dwarfed the religious figures in the paintings. The showiest patron of all may have been Empress Wu Zetian, whose desire for divine projection—and protection—led her to oversee, in 695, the creation of the complex's largest statue, a 116-foot-tall seated Buddha.

By the late tenth century the Silk Road had begun to fade. More caves would be dug and decorated, including one with sexually charged tantric murals that was built in 1267 under the Mongol Empire founded by Genghis Khan. But as new sea routes opened and faster ships were built, land caravans slipped into obsolescence. China, moreover, lost control over large portions of the Silk Road, and Islam had started its long migration over the mountains from Central Asia. By the early 11th century several of the so-called western regions (part of modern-day Xinjiang, in China's far west) had been converted to Islam, and Buddhist monks placed tens of thousands of manuscripts and paintings in a small side chamber adjoining a larger Mogao grotto.

Were the monks hiding documents for fear of an eventual Muslim invasion? Nobody knows for sure. The only certainty is that the chamber—now known as Cave 17, or the Library Cave—was sealed up, plastered over, and concealed by murals. The secret cache would remain entombed for 900 years.

Their canvases consisted of river mud mixed with straw. But Dunhuang's artists would record on these humble surfaces the evolution of Chinese art—and the transformation of Buddhism into a Chinese faith.

THE DIAGONAL SCAR gouged by an ancient sand drift is still visible on the murals outside Cave 17. By the turn of the 20th century, when a Taoist priest named Wang Yuanlu became the sanctuaries' self-appointed guardian, many of the abandoned grottoes were buried in sand.

In June 1900, as workers cleared away a dune, Wang found a hidden door that led to a small cave crammed with thousands of scrolls. He gave some of them to local officials, hoping to elicit a donation. All he received was an order to seal up the contents of the cave.

It would take another encounter with the West to reveal the secrets of the caves—and to sound China's patriotic alarms. Aurel Stein, a Hungarian-born scholar working for the British government in India and the British Museum, made it to Dunhuang in early 1907 using Xuanzang's seventh-century descriptions to guide him across the Taklimakan Desert. Wang refused to let the foreigner see the bundles from the Library Cave—until he heard that Stein too was a keen admirer of Xuanzang. Many of the

Jewelry encrusted with gold leaf makes this seventh-century portrait of the Bodhisattva Guanyin seem three-dimensional—and thus more real. Depicted as a male figure in Indian Buddhism, Guanyin would gradually transform into a female in China, in part to accommodate older Chinese beliefs in a female goddess of mercy.

CAVE 57, PAGE 131

manuscripts, it turned out, were Xuanzang's translations of the Buddhist sutras that he had brought from India.

After days of wheedling Wang and nights of removing scrolls from the cave, Stein left Dunhuang with 24 cases of manuscripts and five more filled with paintings and relics. It was one of the richest hauls in the history of archaeology—all acquired for a donation of just 130 pounds sterling. For his efforts, Stein would be knighted in England, and forever vilified in China.

Stein's cache revealed a multicultural world more vibrant than anyone had imagined. Nearly a dozen languages appeared in the texts, including Sanskrit, Turkic, Tibetan, and even Judeo-Persian, along with Chinese. The used paper on which many sutras had been copied offered startling glimpses into daily life along the Silk Road: a contract for trading slaves, a report on child kidnapping, even a Miss Manners-style apology for drunken behavior. One of the most precious objects was the Diamond Sutra, a 16-foot-long scroll that had been printed from woodblocks in 868, nearly six centuries before Gutenberg's Bible.

Others—French, Russian, Japanese, and Chinese—quickly followed in Stein's path. Then in 1924 came American art historian Langdon Warner, an adventurer who might have served as inspiration for the fictional Indiana Jones. Enthralled by the beauty of the caves—"There was nothing to do but to gasp," he later wrote—Warner nevertheless contributed to their destruction, hacking out a dozen mural fragments and removing an exquisite Tang-era sculpture of a kneeling bodhisattva from Cave 328. The art is still in the careful custody of the Harvard Art Museum. But the defaced murals—and the empty space where the sculpture once knelt—are heartrending all the same.

The bodhisattva at far left, a fragment pried from this High Tang (705-780) mural by art historian Langdon Warner in 1924, is now in the Harvard Art Museum's collection. The scar is visible above. Warner and others removed many artifacts from the caves in the early 20th century. It's a source of continuing ire in China that museums around the world display some of the missing pieces.

CAVE 320, PAGE 132. LEFT: HARVARD ART MUSEUM/ARTHUR M. SACKLER MUSEUM

Scaffolding rises in a tenth-century grotto, part conservation effort to stave the effects sand, salt, soot—and the damp breath tourists.

On the dunes above the cliff face, workers lay down a grid of straw to combat a relentless enemy: windblown sand. A "great wall" of desert plants will eventually replace the 2.5 miles of synthetic fencing that has reduced sand invasion by 60 percent—ensuring that Mogao, unlike other Silk Road sites, will not be buried beneath the desert.

Some Chinese officials, echoing their counterparts in Egypt and Greece, have called for the Mogao artifacts to be returned. Even the Dunhuang Academy's otherwise dispassionate book on the grottoes has a chapter titled "The Despicable Treasure Hunters." Foreign curators, meanwhile, contend that their museums have saved treasures that might otherwise have been lost forever—destroyed in the wars and revolutions of 20th-century China.

Whatever one's views on the issue, there is an inescapable fact: The scattering of Mogao artifacts to museums on three continents has given rise to a new field of study, Dunhuangology, and today scholars around the world are working to preserve the treasures of the Silk Road.

FAN JINSHI DIDN'T SET OUT to be the guardian of the caves. Back in 1963, when she reported to the Dunhuang Academy, the 23-year-old Shanghai native never imagined she would last ■ year in the forsaken outpost, much less a lifetime. The Mogao caves were impressive, to be sure, but Fan couldn't bear the food, the lack of running water, or the fact that everything—houses, beds, chairs—seemed to be made out of mud.

Then came the Cultural Revolution in 1966, when Chairman Mao's regime laid waste to Buddhist temples, cultural artifacts, and foreign emblems across China. The Mogao caves were ■ natural target. Fan's group didn't avoid the ferment; the staff of 48 split into about a dozen revolutionary factions, then spent their days condemning and interrogating each other. But for all the bitter infighting, the factions agreed on one principle: The Mogao caves should not be touched. Says Fan, "We nailed shut all the gates to the grottoes."

Nearly half a century later, Fan is leading a very different sort of cultural revolution. As afternoon sunlight streams into her office at the Dunhuang Academy, the director—a diminutive woman with short salt-and-pepper hair—gestures out the window toward the

dun-colored cliff face. "The caves have almost every ailment," she says, rattling off the damage caused by sand, water, soot from fires, salt, insects, sunlight—and tourists. Fan oversees a staff of 500, but she recognized as far back as the 1980s that the academy could use the help of foreign conservationists. This may sound simple, but collaborating with foreigners is a sensitive issue at Chinese cultural heritage sites—and the plunder of the Mogao caves a century ago serves as a powerful cautionary tale.

The sky outside Fan's window, cloudless and eggshell blue for days, suddenly darkens. A sandstorm has kicked up. Fan notices only long enough to remember the first project she undertook with one of the academy's longest serving partners, the Getty Conservation Institute (GCI). To prevent the kind of sand invasion that had buried some of the caves—and damaged paintings—GCI erected angled fences on the dunes above the cliff, reducing wind speeds by half and decreasing encroachment by 60 percent. Today the academy has dispatched bulldozers and workers to plant wide swaths of desert grasses to perform the same job.

The most painstaking efforts occur inside the caves. GCI has also set up monitors for humidity and temperature in the caves and is now measuring the flow of tourists as well. Its biggest project took place in Cave 85, a Tang dynasty grotto where GCI and academy conservationists worked for eight years devising a special grout to reattach mural segments that had separated from the rock face.

At a site this old, ethical ambiguities abound. In Cave 260, a sixth-century grotto that the University of London's Courtauld Institute of Art is using as a "study cave," Chinese students recently used micro-dusters to clean the surfaces of three small Buddha images. Almost invisible before, the Buddha's red robes suddenly sparkled. "It's wonderful to see the painting," says Stephen Rickerby, a conservator who is coordinating the project. "But we're ambivalent. The dust contains salts that can damage the paint, but removing the dust exposes it to light that will cause it to fade."

This is the dilemma Fan Jinshi faces: how to conserve the caves while exposing them to a wider audience. The number of tourists visiting Mogao reached more than half a million in 2006. The income has buoyed the Dunhuang Academy, but the moisture from all the breathing could damage the murals more than any other factor. Tourists are now limited to a rotating set of 40 caves, ten of which are open at any given time.

Most other Silk Road sites were devoured by the desert or destroyed by successive empires. But the Mogao caves endured largely intact, their kaleidoscope of murals capturing the early encounters of East and West.

Digital technology may provide one solution. Following up on a photo-digitization project completed in 23 caves with the Mellon International Dunhuang Archive, the academy has launched its own multiyear marathon to digitize all 492 decorated caves (so far, the staff has completed 20). The effort mirrors an international push to digitize the scattered scrolls from Cave 17.

Fan's dream is to bring together digital archives from East and West to re-create the full three-dimensional experience of the caves—not at the site itself, but in a sleek new visitor's center proposed to be built 15 miles away. The center has not yet moved beyond the planning stages. But Fan believes that reuniting all of Mogao's treasures in one place, even virtually, will guarantee that their glories will never again be buried in the sand. "This will be a way," Fan says, "to preserve them forever." □

Eyes bulging as he tramples a foreign demon, an eighth-century heavenly guard in armor reveals the fiercer side of Buddhist cosmology. The grottoes' modern-day guardians at the Dunhuang Academy seem equally fierce about protecting the caves. Says director Fan Jinshi, "The caves may be in China, but they belong to the world."

CAVE 46, PAGE 131

world beat

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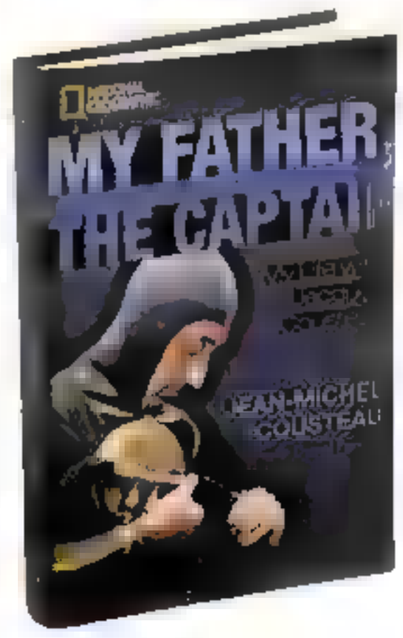
INSIDE GEOGRAPHIC

Adam LeWinter installs a camera on the Greenland ice sheet (top). Back at the airport hangar, team members sort their gear before flying home (above).

ON ASSIGNMENT **Ice Gauge** "It's like Christmas Day when you open up those cameras," says photographer James Balog, referring to the dozens he has stationed around the globe and programmed to snap at regular intervals. The collection is part of the Extreme Ice Survey (EIS), an ongoing project he created to document climate change in glacial landscapes. While on assignment for this issue's "Melt Zone" story, Balog and his assistant, engineer Adam LeWinter, used their EIS techniques to record the shifting melt channels of Greenland. Working 50 miles from the nearest town, the team's long packing list included tents, generators, batteries, and climbing gear. "All that stuff weighed somewhere on the order of 1,200 pounds," estimates Balog. The payoff, he says, is in the pictures: "You see a vanished past that has returned."

Society Updates



NG BOOKS
In *My Father, the Captain,* Jean-Michel Cousteau portrays life with his legendary father, who inspired millions to care about the sea and its creatures. In honor of what would have been Jacques Cousteau's 100th year, this memoir—based on the original French best seller—is in stores now ($26).

NG CHANNEL
Renowned shark scientist Michael Domeier spent the past decade studying great whites off the coast of Mexico. Now, with a team of ace anglers, he takes his work even further in *Expedition Great White,* a new Sunday night series premiering June 6 at 10 p.m. on the National Geographic Channel.

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GeoPuzzle Answers

PHOTOS: JAMES BALOG

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Winning Photos

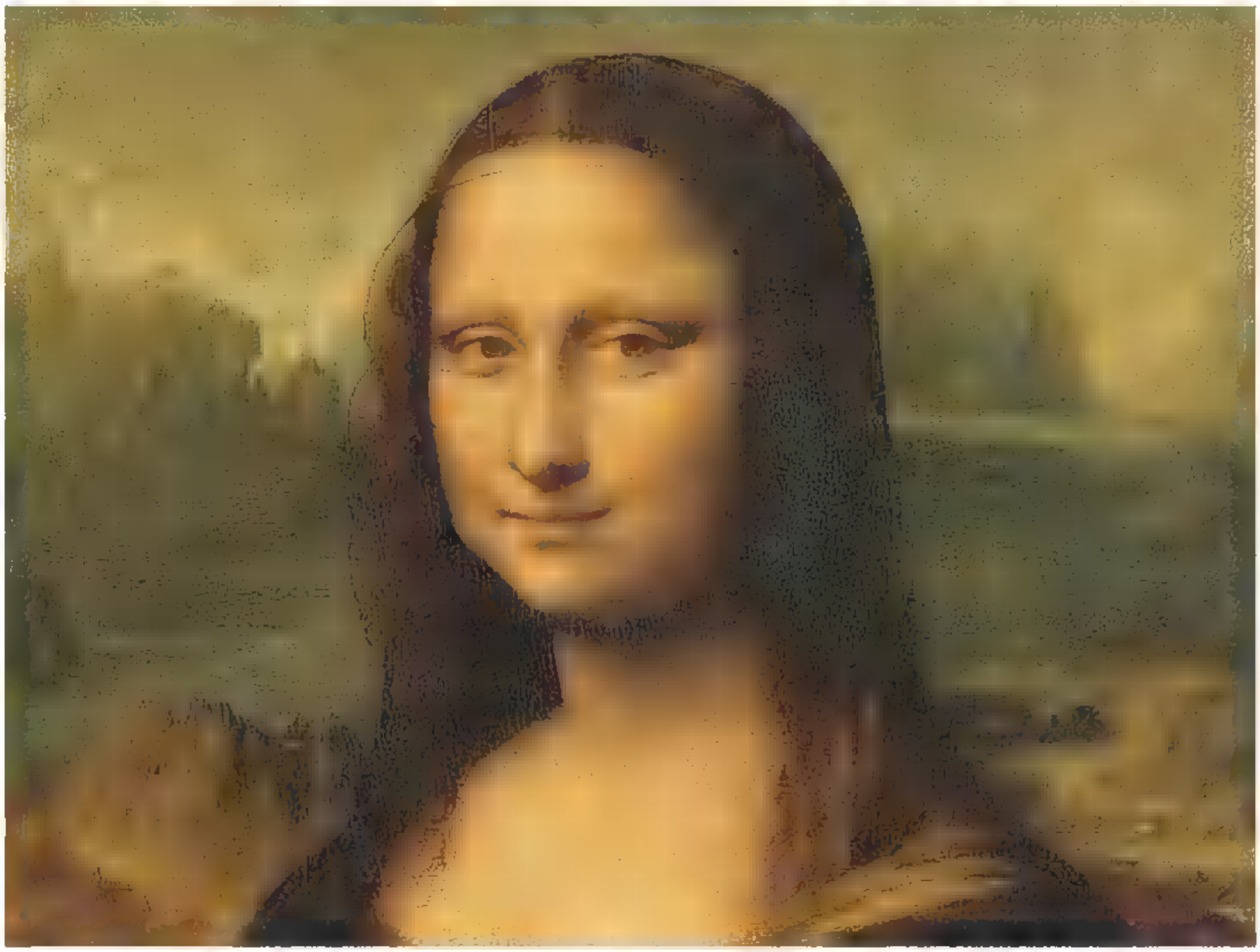
More than 208,000 images were submitted to the fourth annual National Geographic International Photography Contest. Participation was open to readership of *National Geographic*'s English-language edition and 20 of its local-language partners; Poland and China accounted for 129,000 entries alone. Our judges selected photographs by Debra Jansen, Hugo Machado, and William Goodwin—in the categories of People, Places, and Nature—as grand-prize winners.

The winning photographers will receive all-expense-paid trips to National Geographic Society headquarters in Washington, D.C.

NATURE **William Goodwin** of Birmingham, Alabama, snapped this peppermint shrimp perched inside a tube sponge in Margate Bay, Bonaire, in the Netherlands Antilles.

PLACES **Hugo Machado** of Angra do Heroísmo, Portugal, captured the Licancábur Volcano on the border between Chile and Bolivia.

PEOPLE **Debra Jansen** from Atlanta, Georgia, got this shot of an elderly woman waiting at a bus stop in Chamblee, Georgia.



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FLASHBACK

Midnight Fun A series of suns studs the night sky in this multiple exposure. A member of polar explorer Donald B. MacMillan's 1947 expedition to Greenland, photographer Ralph B. Hubbard, Jr., explained, "To obtain the picture, I set my cameras up on a prominence near Refuge Harbor, about 11.5 degrees from the North Pole, and aimed them towards the north. In all I made about 11 exposures of the sun while it was in the field of my camera, with one exposure being made every 20 minutes." The sun shown at the center was shot at exactly midnight. *—Margaret G. Zackowitz*

Flashback Archive Find all the photos at **ngm.com.**

PHOTO: RALPH ■. HUBBARD, JR., NATIONAL GEOGRAPHIC STOCK

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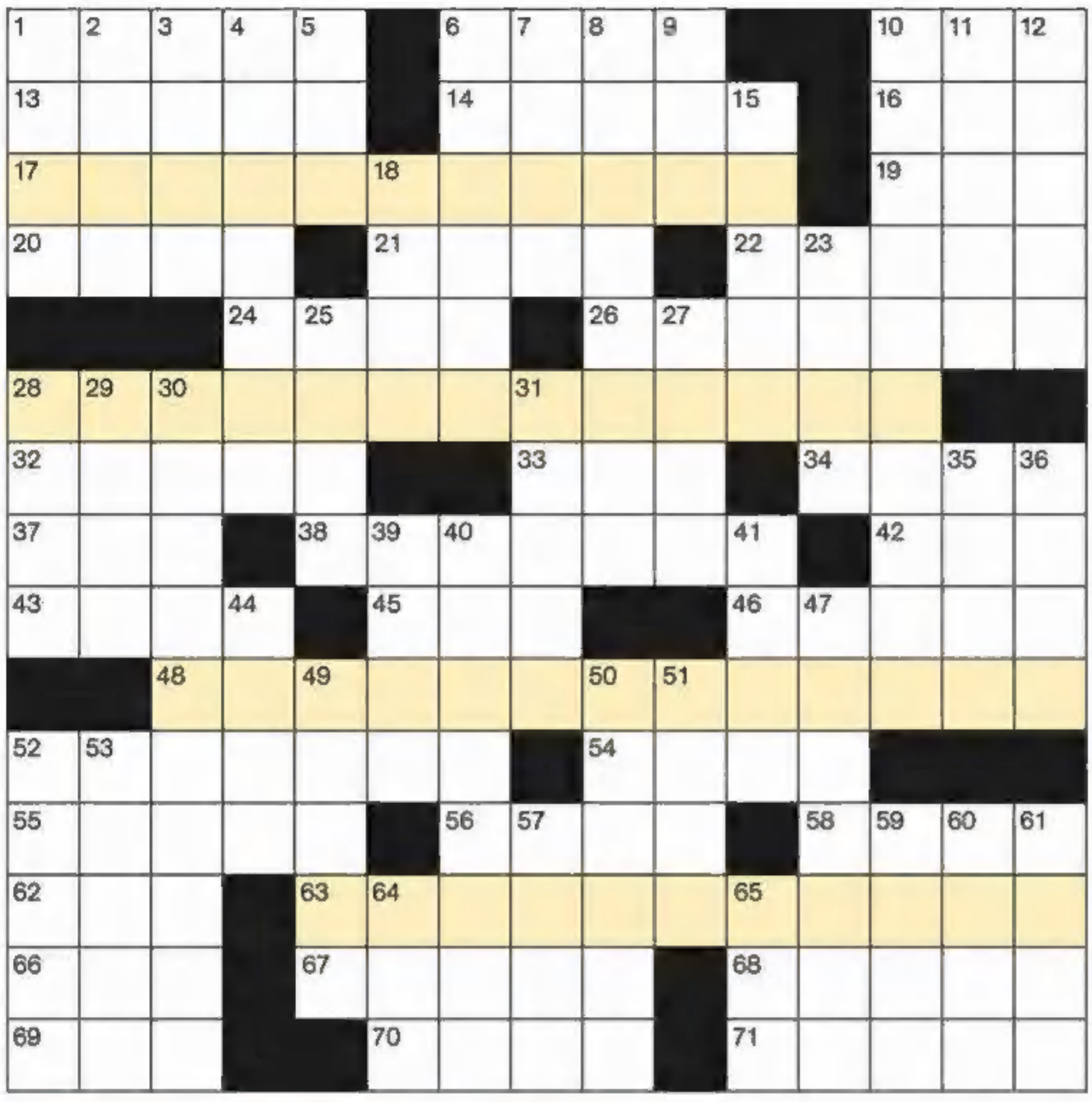

Greenland Grins

Puzzle by Cathy Allis

Wordplay is a Greenland tradition. Consider its name. Though there are green tracts (left), which are growing as Earth warms, ice covers most of the isle. Yet Erik the Red picked "Greenland" to lure settlers. Tinted clues hew to the habit of verbal high jinks.

ACROSS

1 Stiller's partner in laughs and love
5 Part of NBA or PTA
10 Edible stick slice
13 Fairy-tale fiends
14 Formal rulings
16 Giants quarterback Manning
17 Plea to Mother Nature to stop a downslope Greenland wind?
19 Intent
20 It's often mixed with rain in Greenland
21 Concerning
22 "Billie Jean" singer's nickname
24 "Say it __ so!"
26 Trailblazer
28 Lament of one struggling to learn Greenland's dialect Kalaallisut?
32 Touch and go
33 *The Ice Storm* director Lee
34 Bewildered
37 Have Greenland's "pink gold"
38 Comes forth
42 Misery
43 Grub's habitat
45 Minuteman missile successors, for short
46 Broker
48 Erik the Red and some Vikings, while in Greenland?
52 Metal playing marble
54 Othello's betrayer
55 Ibsen title protagonist
56 Another name for the "hood"
58 Old Venetian magistrate
62 The Buckeyes' sch.
63 Greenland coastal feature of early creation?
66 PC key
67 Cubic meter
68 Masterless samurai
69 Not clerical
70 Harness-race pace
71 2009 Nobel Peace Prize winner

DOWN

1 He assigned gypsum a two
2 Austrian painter __ Schiele
3 Folkie Woody's son
4 Sangria ingredient
5 Zone for Greenland's w. tip
6 Start of a carol that ends with "Dominum"
7 Make finer, as flour
8 Ice-cream-parlor task
9 Ultimate, as degrees go
10 Iceland structure honoring John Lennon
11 Similarly
12 Sea to Australia's north
15 Pear variety
18 Type of gliding
23 Indigo dye source
25 Sore-eye site
27 Pulitzer winner for *Picnic*
28 Bad day for Caesar
29 "Later, Luigi!"
30 Full-time military service
31 Ankle bones
35 Leif and his brothers, to Erik
36 French-style bean?
39 Palindromic year of this century, Roman-style
40 Food additive, perhaps
41 Performed "Nunarput Utoqqarsuanngoravit"
44 Bore false witness
47 "Well done!"
49 Hardly puts down gently
50 Corn kernel, e.g.
51 Greek Earth goddess
52 Sandbar
53 Nikola in electrical power history
57 Prefix with dynamic
59 Mrs. Chaplin, née O'Neill
60 Macabre
61 She's a mixed-up Dane?
64 Giants right fielder Mel
65 Headless hairdo?

Answers in Inside Geographic

PHOTO: PETER ESSICK

Men who will become vice presidents this year:

13,442

Who will retire before age 60:

940

And reconnect with their younger brother:

83

While drifting down the Amazon:

1

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